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NICHTER ARE ARE U.S. PAT, OFF

and other alloys



THE Historical Map of the United States of America, used as the cover illustration of this book, represents the development of the Electric Light and Power Industry.

(Data given below is reproduced from panel on back cover)

- 1876—A system of electric lighting by arc lamps perfected by Charles F. Brush.
- 1879—High resistance incandescent electric lamp invented by Thomas A. Edison.
- 1880—Experimental Central Station operated by Edison at Menlo Park, N. J.
- 1882—First commercial central station on Pearl Street, City of New York.
 First hydro-electric central station at Appleton, Wisconsin.
- 1883—Three-wire direct current system of electric distribution installed at Sunbury, Pennsylvania.
- 1884—Sprague Motor introduced. First electric street railway transportation in Cleveland, Ohio.
- 1885—National Electric Light Association founded. Invention by William Stanley of transformer for alternating current.
- First regulating commission, Massachusetts.

 1886—First commercial lighting system using alternating current operated by William Stanley at Great Barrington, Massachusetts.

 George Westinghouse established alternating current plant at
- Buffalo, N. Y. 1888—Tesla invented polyphase alternating current motor without commutator.
- 1891—The first steam railway to electrify part of its line was the Baltimore & Ohio Railway at Baltimore, Md.
- 1892-Work started on Niagara Falls Power Plant.
- 1893—The electric flat iron, the first household appliance operated by electric current was exhibited at World Fair, Chicago, Ill.
- 1896—High tension alternating current transmission lines with substations for the transformers were introduced.
- 1903—First all turbine central station built in Chicago with 5,000 kw. units.
- 1906-Tungsten filament lamp introduced.
- 1907—First modern regulating commission with broad powers—New York and Wisconsin.
- 1914—Customer ownership started in the territory of the Pacific Gas & Electric Co.
- 1920-Federal Water Power Act.
- 1922-First Commercial mercury turbine 2,000 kva., Hartford, Conn.

In the decade following the World War, Electric Light and Power Industry enjoyed great growth and prosperity. The period was characterized by the application of the idea of "Superpower" through the interconnection of generating system, by the extension of electric service to household appliances on a greater scale, by the advancement of farm electrification and by the development of large scale organizations through mergers and centralized control.

While this historical outline covers the major developments in the art—between the lines were thousands of inventions that have contributed mightily toward electrical advancement. It is a significant fact, that for each invention which required resistance alloy as an integral part the inventor had at his disposal a fully developed dependable resistance in the form of "Nichrome."

THIS BOOK, R-28

HAS BEEN COMPILED BY

DRIVER-HARRIS COMPANY

AS AN AID TO THOSE UPON WHOM RESTS THE RESPONSIBILITY FOR THE PROPER SELECTION OF ALLOYS USED IN MANUFACTURING PROCESSES

In Canada, The B. Greening Wire Co. Ltd., Hamilton

DATA AND SPECIFICATIONS
PERTAINING TO

ALLOYS
FOR ELECTRICAL
RESISTANCE



Plant at Harrison, New Jersey



Plant at Morristown, New Jersey

The Scope of Driver-Harris Alloys

THIS catalog is designed to cover the properties and characteristics of alloys for electrical resistance and electrical heating

applications.

The activities of the Driver-Harris organization extend to a great many other industries which require alloys of unusual qualities made to very strict specifications. Years of experience have familiarized our staff with the problems of resistance to heat, including mechanical stresses, oxidation and chemical corrosion produced by high temperatures. We are also prepared to offer materials to be used in high vacuum applications, in spark plug electrodes and in many branches of the automotive industry.

In fact, the entire range of industries requiring high quality castings, bars, rods, sheet, strip, strand and wire, is served with products manufactured in the various mills of the

Driver-Harris Company.

The facilities of the Driver-Harris Company comprise highest types of modern equipment, including both arc and induction electric melting furnaces, hot rolling mills, complete foundry, steam hammers, cold rolling sheet and strip mills, wire drawing equipment, insulating machinery, heater cord machinery and research laboratories—all under the supervision of a thorough staff of engineers and metallurgists.

Manufacturing plants are located in Harrison, New Jersey; Morristown, New Jersey; Manchester, England; Gassicourt, France;

and Torino, Italy.

The Driver-Harris Company also maintains branch offices at General Motors Building, Detroit; 562 West Randolph Street, Chicago, and 7016 Euclid Avenue, Cleveland. In the Chicago Branch ample stocks are available for immediate service to customers.

Contents

	PAGE
Scope of Driver-Harris Alloys.	5
NICHROME IV	
Description and Application	3 and 9
Properties and Price List	10
Current Temperature Characteristics	12
Temperature Resistance Chart	13
Resistance of "Nichrome" IV Ribbon.	14
Feet per Pound of "Nichrome" IV Ribbon	15
Prices of "Nichrome" IV Ribbon	16
Hot Rolled Strip, Rounds and Squares.	17
Design of "Nichrome" IV Heating Elements.	20
Registered Trade Marks	21
NICHROME	
Description and Application 22	
Properties and Price List	24
Temperature Resistance Chart	
Current Temperature Characteristics	26
Resistance of "Nichrome" Ribbon	27
Prices of "Nichrome" Ribbon	28
Hot Rolled Strip, Rounds and Squares.	
Design of "Nichrome" Heating Elements) and 31
No. 95 ALLOY	
Description and Application	32
Properties and Price List	33
HEATER CORD	
Description34	
Types and Styles	and 3
ADVANCE	
Description and Application	
Temperature Resistance Chart	
Properties and Price List.	. 40

Contents

	PAGE
Current Temperature Characteristics	
Resistance of "Advance" Ribbon	42
Prices of "Advance" Ribbon	
LUCERO	
	1 45
Description and Application	
Temperature Resistance Chart	
Properties and Price List	47
MANGANIN	
Description and Application	48
Properties and Price List	49
PURE NICKEL	
	50
Description and Application.	50
Temperature Resistance Chart	51
Properties and Price List.	52
Cold Rolled	53
COMET	
Description, Application, Properties and Price List	54
Size Limits Cold Rolled and Hot Rolled Products	55
"Nichrome" Sheet	56
Additional D-H Alloys	57
USEFUL DATA	
Ohms Law	58
Properties of Materials	59
Weight of Resistance Ribbon in Pounds Per 1000 Ft	60
Weight per Running Foot of Rounds, Squares, Hexagons and	
Octagons	61
Weight per Running Foot of Flats	62
Conversion Factors	63
Conversion Tables for Fahrenheit and Centigrade Scales	64
Comparison of Wire Gauges	65
"NICHROME" CASTINGS	66
Weights of Coils and Spools	67
Summary of D-H Products	68



THE application of electrical energy to industrial heating has so many advantages that the field for electric heating apparatus includes the entire industrial world, there being scarcely a manufacturing plant that does not require accurate and automatically-controlled heating equipment which means electric heat.

The modern home, where convenience and refinement are the prime considerations, also requires high grade electrical cooking and heating appliances.

To provide a resistor material that will endure the high temperatures necessary for the satisfactory operation of electric furnaces, ovens, heaters, ranges and special appliances is a difficult metallurgical problem.

"Nichrome" IV elements are used



"Nichrome" IV (Karma), the most recent development of the Driver-Harris Company, is a super nickelchrome resistance alloy and is specially made for this high temperature service. It will effectively resist oxidation at temperatures up to 1150° C. (2102° F.).

This super-nickelchrome alloy is made of the purest nickel and chromium available. The induction furnace melting process used exclusively by the Driver-Harris Company in making this product, inhibits the formation of oxide inclusions and all other contaminations.

Special processes during the successive stages of manufacture insure, in the finished product, the high quality inherent in the metal because of the selection of raw materials and the melting operation.

Rigid inspections and tests are applied at each step of the manufacture to insure "Nichrome" IV fulfilling the demands encountered in heavy duty heating apparatus, operating at high temperatures for long periods.

in these electric furnaces



Nichrome IV

The Super Nickelchrome Wire

Specific resistance 650 ohms per circular mil-foot at 20°C. (68°F.). For temperature resistance chart see page 13.

Factors to be used in determining resistance at elevated temperatures.

Temp. Cent Temp. Fahr Resis. in Ohms		68	212	392	572	400 752 0 1 049	932	1112	1292	1472	1652	1832
No. Diam.	Oh	nms	11	Veight Per		Fe	et		Oh:	ms		st Price Per

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire	List Price Per Pound Bare Wire
1 2 3 4 5	289 .258 .229 .204 .182	.0077 .0097 .0123 .0156	239.0 190.0 150.0 119.0 95.0	4 .32 5 .40 6 .88 8 .65 10 .9	. 033 . 052 . 085 . 134 . 214	\$4.05 4.05 4.05 4.05 4.05
6 7 8 9	.162 .144 .128 .114 .102	.0247 .0313 .0396 .0501 .0624	72.0 59.0 47.0 37.6 29.2	13.7 17.4 22.0 27.8 34.7	.363 .545 .871 1.39 2.17	4.05 4.05 4.05 4.11 4.17
11 12 13 14 15	.091 .081 .072 .064 .057	.0784 .0990 .1253 .1586 .2000	23.7 18.8 14.8 11.7 9.3	43.6 55.0 69.5 88.0	3.42 5.45 8.71 13.9 22.2	4.23 4.32 4.41 4.50 4.59
16 17 18 19 20	.051 .045 .040 .036 .032	.2499 .3209 .4062 .5015	7.45 5.73 4.57 3.70 2.93	139 178 225 279 352	34.7 57.1 91.4 140 223	4.68 4.80 4.95 5.18 5.40
21 22 23 24 25	.0285 .0253 .0226 .020 .0179	.8002 1.015 1.272 1.625 2.028	2.32 1.83 1.46 1.15 0.91	444 563 708 903 1,130	355 571 901 1,511 2,291	5.70 6.15 6.60 7.20 7.80
26 27 28 29 30	.0159 .0142 .0126 .0113	2 571 3 223 4 094 5 090 6 500	0.72 0.58 0.46 0.365 0.286	1,425 1,790 2,280 2,830 3,600	3,663 5,769 9,334 14,400 23,400	8 . 40 9 . 00 9 . 60 10 . 20 10 . 80
31 32 33 34 35	.0089 .008 .0071 .0063 .0056	8.206 10.15 12.89 16.37 20.72	0.226 0.183 0.144 0.113 0.090	4,550 5,630 7,150 9,100 11,500	37,330 57,140 92,160 148,960 238,000	11.40 12.00 12.90 14.10 15.75
36 37 38 39 40	.005 .0045 .004 .0035 .0031	26.00 32.09 40.62 53.06 67.63	0.071 0.058 0.046 0.035 0.026	14,400 17,800 22,500 29,500 37,500	374,400 571,000 914,000 1,565,000 2,536,000	18.00 21.00 25.50 31.50 39.00
10	.00275 .0025 .00225 .002 .00175 .0015	85 95 104 0 128 3 162 5 212 2 288 8	.02147 .01775 .01437 .01136 .00769 .00639	47,500 57,700 71,500 90,000 117,000 160,000	4,082,000 6,000,000 9,175,000 14,625,000 24,800,000 46,200,000	48.00 60.00 75.00 90.00 112.00 142.00

Unless otherwise specified material listed above will be supplied soft temper. Prices of Cotton and Silk Covered Wires furnished on request.

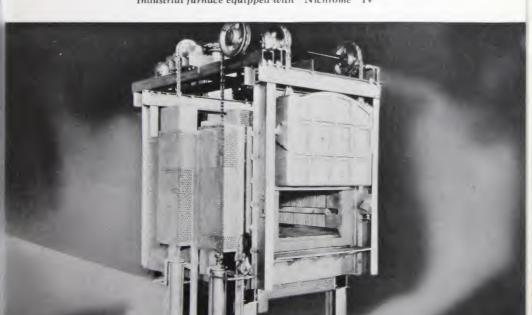
THOSE industries which utilize heat in the manufacture of their products are gradually and steadily turning to electricity.

Electric heat, capable of so many refinements and of such accurate control, is essential to many processes. In the successful application of electric heat "Nichrome" is indispensable.

Driver-Harris Alloys are found in all parts of the industrial world. Only a few installations are illustrated in this catalog, but wherever quality is considered for electric heating, there "Nichrome" and "Nichrome" IV will be found.

As the best means of determining quality of their products, the Driver-Harris Company has used life tests of its wires. The extensive use of life tests in the development of nickelchrome wire for electric heating necessitated the development of a complete laboratory and methods of testing.

The Driver-Harris Technical staff will be glad to furnish, upon request, further information concerning life tests and their services and laboratory facilities are at your disposal.



Industrial furnace equipped with "Nichrome" IV

Current Temperature Characteristics of

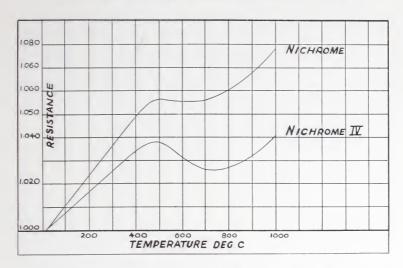
Nichrome IV

The Super Nickelchrome Wire

Showing amperes necessary to produce a given temperature. Applying only to straight wires stretched horizontally in free air.

В.	Diam.	200	300	400	500	600	700	800	900	1000	1100°C
& S.	in Inches	392	572	752	932	1112	1292	1472	1652	1832	2012°F
1 2 3 4 5	289 258 229 204 182	87.0 74.0 62.6 53.1 44.5	113 96.0 81.5 69.0 58 4	117	166 141 119 101 85.3	195 165 140 119 101	227 193 164 139 117	257 218 185 157 133	292 248 211 178 151	332 281 239 202 171	378 320 272 230 195
6 7 8 9	162 144 128 114 102	37 6 32 1 27 3 23 1 19 5	49-4 41-6 35-4 30-0 25-4	60.0 50.8 43.1 36.5 30.9	72 2 61 0 51 9 43.8 37.1	85.0 72.0 61.0 51.6 43.7	99 0 83 8 71 0 60 0 51 0	112 95.0 80.6 68.0 57.7	128 108 91 5 77.5 65.6	144 122 104 87.6 74.4	164 139 118 100 85
11 12 13 14 15	.091 .081 .072 .064 .057	16.5 14.0 11.8 10.0 8.50	21 5 18 2 15 3 13 0 11 1	26.1 22.1 18.2 15.9 13.5	31.4 26.6 22.5 19.0 16.2	36 9 31 3 26 5 22 5 19 0	43 0 36.5 30.9 26.1 22.2	48-6 41-3 35-0 29-6 25-1	55.3 47.0 39.8 33.7 28.5	62 6 53 2 45 0 38 1 32 3	71.5 60.8 51.3 43.3 36.8
16 17 18 19 20	051 045 040 036 032	7.20 6.10 5.18 4.37 3.70	7.95 6.73 5.70	9 65 8 20 6 95	9.85 8.35	9.85		21.4 18.1 15.3 12.9 10.9	24.3 20.5 17.4 14.7 12.4	27.5 23.2 19.7 16.7 14.1	31 4 26 4 22 4 19 0 16 1
21 22 23 24 25	0285 0253 0226 020 0179	3 2 65 5 2 26 1 91	3.45 2.84 2.48	4.20 3.57 3.02	5.05 4.30 3.64	5 95 5 06 4 27	6.95 5.90 4.97	7 85 0 6 67 5 63	8 90 7 7.60 8 6 40	8 60	8 2
26 27 28 29 30	.0159 .0142 .0126 .0113	2 1.16	1 51 1 29 1 11	1.84 1.58 1.35	2 21 1 89 1 62	2 .61 2 .23 1 .92	3 04 2 60 2 2 23	3 44 2 94 3 2 55	3 90 4 3 35 2 2 95	3 - 89 5 3 - 89 5 3 2	2 5 0 9 4 4 5 3 70
31 32 33 34 35	-0089 008 .0071 .0063	. 54 1 . 46 3 . 40	. 70 5 . 60 5 . 52	. 86 . 74 2 63	1.03 .88 .77	1 21 1 02 .90	1 42 1 1 2 1 1 0	2 1 6 1 1 3 4 1 1	0 1 8: 7 1 5: 8 1 3:	2 2 00 6 1.7 4 1.5	6 2 35 7 2 02 2 1 73
36 37 38 39 40	.005 .004 .004 .003 .003	5 .25 .21 5 .18	. 33 . 28 . 3	3 .40 3 .34 4 .29	. 48 4 . 41 9 . 35	3 .5' -49 5 4	7 6 9 5 1 4	5 .7 7 .6 9 .5	5 .8 4 .7 4 .6	5 .9 3 .8 2 .7	6 1 10 2 93 0 .80

Temperature Resistance Chart Nichrome IV and Nichrome



The temperature coefficient curves of "Nichrome" and "Nichrome" IV shown above represent wire slowly cooled from 1000° C., as specified by the American Society for Testing Materials. Slight variations from this curve may be expected due to variations in methods of annealing of different sizes of wire.

Heat-treating furnace equipped with "Nichrome" IV elements



Resistance of Nichrome IV

The Super Nickelchrome Ribbon

Specific Resistance 510 ohms per sq. mil-foot at 20°C. 68°F.

Factors to be used in determining resistance at elevated tempertures. These figures are given as a basis for engineering calculations and represent average material as received.

Temp. Cent. Temp. Fale.		20	900 171	300 391	900 571	400 752	500 920	680 1112	100	800 (47)	908 1651	3000 1837
s can in where .	1	000	1 005	1 025	1 (4)	1454	1 053	1 043	1 344	1 046	2 055	1 056

Resistance in Ohms Per Foot at 20°F. (68°C)

Th	ickness				10	15.1-	laches				
10 40 60	Ins.	14	1 26	* 9	1.2	36	19	-3	L	34.	1
10 11 12 13 14 15	064 064				0452 0507	00035 00057 0301 0301 03036 0380	49 (1.65 (021 (0238	01.00 01.01 01.05 01.41 0.35 0.179	0080 0086 0000 0113 0127 0143	01066 0074 0083 0084 0006 0019	0050 0056 0062 0070 0079 0089
16 17 18 19 21	061 045 040 036 032			108 120 135	086T 0643 723 0803 0904	(425 (481 (541 (602 (678	0286 0302 0340 0377 0425	(00.00) (0006) (0055) (0053) (0016)	0.160 0181 0204 0225 0255	.0133 .0151 .0170 .0188 .0212	0000 0113 0127 0141 0141
	1055 1051 1005 101 179		- 434 - 435	152 172 192 217 242	101 114 128 144 161	0761 0857 0900 100 114	0477 0600 0600 0680	451 451 6.0 669	(035 (1802) (1861) (1418) (435)	(0008 (0068 (0300 (0540 (0079	00 78 0201 0205 0258 0284
25	0159 0142 0125 0113	1 736	5.0f 611 688 768 868	273 305 344 384 434	151 203 209 290 327	128 144 162 181 214	0855 0867 107 120 136	0641 0715 0809 0902 1902	0513 0514 0647 0712 0816	0427 0478 0539 0601 0680	0336 0454 0450 0450
1188333	0086 008 0 TO 0 ES	1 950 1 170 2 445 1 755 3 100		457 614 682 781	366 419 461 521 585	229 255 257 324 364	152 170 151 215 242	115 127 143 161 182	0916 100 114 129 145	0764 .0850 .0857 1.079 1.214	0.573 0.63 0.713 0.805 0.910
533399	005 0045 004 0005 0081	1 472 1 856 4 96 5 6.0	1 529 1 45 2 808	983 1 092 1 228 1 4 4 1 585	655 704 519 -936	408 453 530 983 678	2772 3002 340 388 439	2.4 225 255 291 329	163 181 214 233 263	136 151 170 194 219	. 102 103 127 145 164

After careful investigation by a committee of the American Society for Testing Materials, working in conjunction with the U.S. Bureau of Standards, it has been found that the cross-sectional area of ribbon having rounded edges depends about the ratio of which to thickness, and is always less than a cross-section of having the maximum with a and thickness of the ribbon.

The continues of the cibbs.

First a sizes of and by COSS and those and it to be marrowed that a strong of the continues that a size and the continues that it is continued to a cross section of S less has a true rectangle while those sizes which have a ratio of will to thickness greater has 15 to 1 are calculated on a cross-section of 17, less than a true rectangle.

Unless otherwise specified material listed above will be supplied soft temper-

Feet Per Pound of Nichrome IV The Super Nickelchrome Ribbon

Thic	kness				Wid	lth—Inc	ches				
B & S.	Ins.	1/32	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
10 11 12 13 14 15	.102 .091 .081 .072 .064 .057				24.5 25.8	11.6 13.3 14.5 16.3 18 20.2	7.1 8.2 9.1 10.2 11.4	5 3 6 1 6 7 7 6 8 5 9 7	4.2 4.9 5.4 6.0 6.8 7.7	3 5 4 1 4 5 5 0 5 7 6 4	2.6 3.0 3.4 3.8 4.3 4.8
16 17 18 19 20	.051 .045 .040 .036 .032			59.4 65 73.7	31 35 38.6 42.3 48	22.8 25.7 28.4 31.5 35.8	14.5 16.5 18.4 20.3 23.2	10.8 12.3 13.8 15.3 17.4	8.7 9.9 11 12.2 13.9	7-3 7.9 9.1 10.2 11.5	5.4 6.2 6.9 7.6 8.7
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		237 265	80.5 92.6 101 115 129	53.5 60.7 66.9 75.3 82.7	40 45.3 48.8 55.3 62.1	25 9 29 5 32 5 36 8 41 4	19_4 22_1 24_4 27_5 31_1	15.5 17.7 19.6 22.1 24.7	13 14 7 16 3 18 4 20 7	9,7 11 12.2 13.8 15.5
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	950	295 326 366 407 457	143 160 179 196 221	92.6 103 117 131 147	69.5 77.9 88.5 97.8	46 4 52 58 2 65 4 73 7	34 8 38 9 44 2 48 8 55 3	27.8 31 35.4 39.1 44.2	23 . 2 25 . 9 29 . 5 32 . 5 36 . 8	17.4 19.3 22 24.4 27.6
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	1070 1180 1310 1470 1670	512 571 636 716 804	248 277 312 351 402	159 185 206 234 268	127 141 159 180 201	79.2 92.3 104 117 134	63.5 71 80 89 8 100	50 8 56 5 63 6 71 7 80 2	42 4 47 53 59 8 67	31.8 35.2 39.8 45 50.1
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	1830 1980 2260 2590 2910	884 960 1105 1262 1425	442 480 551 631 712	295 320 369 421 474	221 240 276 316 356	147 160 184 211 237	110 120 138 158 178	88.5 96 111 126 142	73_5 80 92 105 119	55.2 60 68.5 79 88.4

Unless otherwise specified material listed above will be supplied soft temper.

Pit type furnace with "Nichrome" IV elements



List Price Per Pound of Nichrome IV

The Super Nickelchrome Ribbon

This	kivess			Width	—Inches		
BAS	Inches	160	(le	Ja.	3%	5.0	t ₄ to 1
24 25 26 27 28	020 0179 0159 0142 0126			\$6 45 6 60 6 75 6 90 7 20	\$6 30 6 45 6 60 6 75 6 90	\$6 15 6 30 6 45 6 60 6 75	\$6 00 6 15 6 30 6 45 6 60
29 30 31 32 33	0113 010 0089 008 0071	\$19 20 20 10	\$11 70 12 00 12 30 12 90	7 50 7 80 8 10 8 40 8 70	7 05 7 20 7 35 7 50 7 80	6 90 05 20 7 35 7 65	6 75 6 90 7 20 7 50 7 80
34 35 36 37 38	0063 0056 005 0015 004	21 00 22 50 24 00 25 50 27 75	13 50 14 40 15 30 16 20 17 40	9 00 9 30 9 75 10 50 12 00	8 25 8 70 9 30 9 90 10 80	8 10 8 85 9 60 10 50 12 00	8 40 9 30 10 50 12 00
39	0035	30 75 34 50	19 20 21 75	15 00 18 00	13 50 16 50	15 00 18 00	

SPECIAL SIZES

Thickness	Width	Tlackness	Width
Inches	Ly to 234	Inches	le to 244"
100 080 080 070	\$5 10 5 10 5 10 5 10 5 10	050 040 030 020	\$5 25 5 40 5 70 6 00

Prices at "Nichrome" IV Ribbon of special dimensions furnished on request. Unless otherwise specified material listed above will be samplied soft temper.

Typical heaters with "Nichrome" and "Nichrome" IV elements



Hot Rolled Nichrome IV

(For tolerances see page 55)

Strip

Specific resistance 510 ohms per square mil-foot. Since the cross sections are not true rectangles because of the rounded corners, the resistance figures in this table are 8% above the theoretical rectangular section. Approximate weight per cubic inch 0.31 lb.

Size	Ohms	Weight	List Price
Inches	Per Foot	Per Foot	Per Pound
58 x .100	. 0082	.21	\$4.05
78 x .125	. 0046	.374	
118 x .125	. 0035	.490	
158 x .125	. 0024	.720	
218 x 366	. 00126	1.36	
4 x 14	. 00049	3.5	

Rounds and Squares

The unit of weight is 0.31 lb. per cu. in. In the case of 1" squares and smaller, the rounded corners will decrease the weight and increase the resistance per foot by about 3%. On larger squares, the error is approximately 6%. The following table is on this basis.

	RO	OUNDS			SC	UARES	
Size Inches	Ohms Per Foot	Weight Per Foot	List Price Per Pound	Size Inches	Ohms Per Foot	Weight Per Foot	List Price Per Pound
1/4 5/66 3/8 7/66 1/2 5/8 3/4 1 1/8 1/4 1/3/8 1/2	.010 .0067 .0044 .0032 .0025 .0016 .0011 .0006 .000493 .000400 .000330 .000277	.172 .257 .390 .537 .690 1.07 1.56 2.86 3.69 4.56 5.52 6.57	\$3.60 3.60 3.60 3.60 4.05 4.05 4.05 Prices on Application	1/4 5/6 3/8 7/6 1/2 5/8 3/4 1	.0078 .005 .0035 .0026 .0020 .00125 .00087 .00049	. 22 .344 .491 .661 .860 1.37 1.98 3.5	\$3.60 3.60 3.60 4.05 4.05 4.05 4.05

For prices of Hexagons and Octagons use list prices of Squares. Unless otherwise specified material listed above will be supplied soft temper.

The Electric Range

THOUSANDS of electric ranges have been sold in years past and thousands more will be sold during the coming years. The convenience and cleanliness of electric heat and the quality and tastiness of food prepared electrically are recognized factors and the time is coming when every modern home will be equipped with an electric range together with cord-attached appliances. "Nichrome" IV, the super nickelchrome resistor, is doing its part to make the electric range a reliable and useful adjunct to the electrical home.



Cooking equipment of one of Chicago's largest hotels in which
"Nichrome" IV elements are used





Suggestions on Design of Nichrome IV Heating Elements

The Super Nickelchrome Wire

The table below gives size of "Nichrome" IV suggested for a given number of watts at 110 volts. The sizes selected are those which will operate at approximately 1700° F. in open coils and are suitable for radiant heaters, range units, etc.

110 Volt Circuit

Watts	Amperes	B. & S. Size	Ohms 75° F	Len	gth
300 325 350 375 400	2 72 2 95 3 2 3 4 3 64	25 24 24 24 24 23	37 6 34 7 31 6 30 1 25 1	19 Ft. 22 20 19 22	4 Ins 5 5 6 10
425 450 475 500 525	3 87 4 10 4 32 4 55 4 77	23 22 22 22 22	26 4 25 0 23 7 22 5 21 5	21 25 24 23 22	5 4 0 0
550 575 600 625 650	5 23 5 46 5 67 5 91	21 21 21 21 21 20	20 5 19 6 18 7 18 0 17 3	26 25 24 23 28	7 6 4 5 5
675 700 725 730 775	6_15 6_36 6_58 6_82 7_04	20 20 20 20 20 19	16 6 16 1 15 6 15 0 14 5	27 26 25 24 30	3 5 7 0
830 830 900 950 1000	7 26 7 72 8 17 8 63 9 08	19 19 19 19	14 1 13 3 12 5 11 9 11 3	29 27 25 24 29	0 5 10 6 2

For other voltages divide the number of watts required at that voltage by the voltage factor below. Select the nearest number of watts in the 110 volt table, multiply the length in 110 volt table by voltage factor. Suppose a device will require 550 watts and the supply voltage is 150. Factor for 150 volts is 1.36 and 11 = 405 watts. Nearest value in 110 volt table is 400 and would require No. 23 wire. This size should be used on 150 volts but length should be 21 x 1.36 or 28 7".

Voltage Factors on Basis of 110 Volts

Voltage	100	120	150	200	220	240	32
Factor	.91	1.09	1.36	1.82	2.0	2.18	0.29

Each electrical alloy covered by this data book has its special advantages in certain specific uses. These uses are briefly outlined, but are intended as a general guide only.

The data which will enable engineers to establish a working basis for the practical application of these alloys are given in the various tables and charts.

The values given in the tables throughout the catalog are average values and are subject to the usual manufacturing tolerances which vary for the different alloys. We will be pleased to supply tolerances for specific materials upon application.

The following names are registered Trade Marks applying solely to alloy products, described in this catalog, made by the Driver-Harris Company. The right to these names, therefore, belongs exclusively to the Driver-Harris Company:

- NICHROME IV—The Super Nickelchrome wire made for long exposure to extremely high temperatures.
- NICHROME—The Nickelchrome wire universally used for portable electric heating devices.
- COMET—For general use at medium high temperatures.
- ADVANCE—The resistance wire, so well-known for extreme accuracy and dependability, that it is the standard for thermo couples.
- LUCERO—An alloy developed to overcome the objectionable characteristics of German Silver.
- MAGNO—A manganese nickel alloy developed for Spark Plug Electrodes and Ignition purposes.

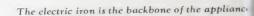
Nichrome

-the great name in appliance heating

"ICHROME" (Calido), which has become synonymous with electrical resistance throughout the world, is the standard of quality recognized by eminent engineers in the electrical industry.

The Driver-Harris Company is the originator of "Nichrome" and has been manufacturing this special alloy for nearly a generation.

Because the increasing demands and rigid specifications of the trade have been satisfied with "Nichrome", it has won universal approval. In fact, "Nichrome" quality is so definitely established that many of the leading manufacturers





and distributors assure their customers by advertising matter and labels that their applicances have *genuine* "Nichrome" heating elements.

This alloy resists oxidation and is non-corrosive. It is giving entire satisfaction as the electrical heating element material in millions of high grade appliances throughout the world.

"Nichrome" has a wide range of application in heating devices operating up to 900° C. (1652° F.), which includes all the cord-attached domestic appliances.

It is also used in general applications such as radio rheostats and potentiometers, high resistance rheostats, industrial rheostats, dipping baskets, woven wire mesh, etc.





Nichrome Resistance Wire

Specific resistance 675 ohms per circular mil-foot at 20°C. 68°F. For temperature resistance chart see page 25.

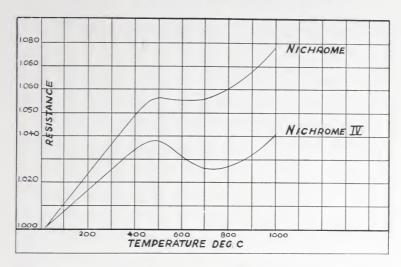
Factors to be used in determining resistance at elevated temperatures

Temp. Cent.	20	100	200	300	400	500	600	700	600	900	1000
Temp Fahr	68	212	392	572	752	932	1112	1292	1472	1652	1832
Parietance in Ohms											

No. B.	Diam. in Inches	Ohms Per Ft at 20°C- (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire	List Price Per Pound Bare Wire
1 2 3 4 5	289 258 229 204 182	0081 0101 0128 0162 0203	231 0 184 0 145 0 115 0 92 0	4 33 5 43 6 90 8 70 10 9	.035 .054 .090 139 218	\$2.70 2.70 2.70 2.70 2.70 2.70
61-89	162 144 1285 114 102	025 0325 0408 0519 0549	73.0 57.0 45.0 36.0 29.0	13 7 17 5 22 2 27 8 34 5	356 560 910 1 44 2 20	2 70 2 70 2 70 2 74 2 78
11 12 13 14 15	.091 081 072 064 .057	0815 102 130 164 207	23 0 18 0 14 0 11 0 9 2	43 5 55 6 69 9 88 5 109	3 52 5 67 9 08 14 51 22 5	2 82 2 88 2 94 3 00 3 06
15 17 18 19	051 045 040 036 032	259 333 421 520 659	7 2 5 6 4 42 3 58 2 83	139 179 226 279 353	36 0 59 6 95 1 145 232	3 12 3 20 3 30 3 45 3 60
21 22 23 24 25	0285 0253 0226 0201 0179	831 1 055 1 321 1 670 2 106	2 24 1 77 1 41 1 12 89	446 565 709 893 1 123	370 590 936 1,491 2,365	3 80 4 10 4 40 4 80 5 20
26 27 25 29 31	0159 0142 0126 0113 0100	2 669 3 347 4 251 5 286 6 750	70 56 44 35 276	1,429 1,786 2,273 2,57 3,623	3 *14 5 9 .77 9 662 15 102 24 455	5.60 6.00 6.40 6.80
31 32 34 34	0089 0080 0071 0063 0056	8 521 10 546 13 39 17 15 21 524	299 177 139 110 087	4.566 5.650 7.194 9.191 11.49	58 906 59 584 96 327 154 601 247 310	7 60 8 00 8 60 9 40 10 50
35 31 35 39	0050 0045 0040 0035 0001	27 000 33 333 42 187 55 102 70 239	069 056 045 034 025	14.490 17.860 22.220 29.410 40.000	391.230 595.327 937.395 1.620.500 2.8.9.500	12 00 14 00 17 00 21 00 26 00
	0.275 0.25 0.225 0.02 0.0175	89 256 108 000 133 333 168 750 220 408	021 017 014 011 005	47 600 58 900 71 500 91 000 125 000	4.248.600 6.361.200 9.533.000 15.356.000 27.551.000	32 00 40 00 50 00 60 00 75 00
	.0015	300 000	.006	166 666	50.000.000	95 O

Unless otherwise specified material listed above will be supplied of temper Prices of Cotton and Silk Covered Wires jurnished on request.

Temperature Resistance Chart Nichrome and Nichrome IV



The temperature coefficient curves of "Nichrome" and "Nichrome" IV shown above represent wire slowly cooled from 1000°C., as specified by the American Society for Testing Materials. Slight variations from this curve may be expected due to variations in methods of annealing of different sizes of wire.

Typical classes of percolators equipped with "Nichrome" and "Nichrome" IV



Current Temperature Characteristics of Nichrome Resistance Wire

Showing amperes necessary for a given temperature. Applying only to straight wires stretched horizontally in free air.

No. B.	Diam.	100	200	300		400	500	600	700		800	900°C.
& S.	In- ches	212	392	572	-	752	932	1112	1292		1472	1652°F.
1 2 3 4 5	.289 .258 .229 .204	54 . 2 45 . 9 38 . 9 33 . 0 28 . 0	100.0 84.5 71.5 60.6 51.4	136.0 115.0 97.5 82.6 70.0	14 12 10	9.0 3.0 1.5 3.0	201.0 170.0 144.0 122.0 103.0	225.0 191.0 162.0 137.0 116.0	254.0 215.0 182.0 154.0 130.0	4	280.0 237.0 201.0 170.0 144.0	308.0 261.0 221.0 187.0 158.0
6 7 8 9	.162 .144 .1285 .114 .102	23.8	43.5 36.8 31.2 26.4 22.4	59.4 50.3 42.6 36.1 30.6	5	73.7 52.5 53.0 14.8 38.0	87.4 74.0 62.6 53.0 44.8	98.7 83.7 71.0 60.0 51.2	110.0 93.5 79.2 67.1 57.0		122.0 104.0 87.6 74.3 63.1	134.0 113.0 96.2 81.5 68.8
11 12 13 14 15	.091 .081 .072 .064 .057	10.4 8.80 7.45 6-31 5 35	19.0 16.1 13.6 11.5 9.77	25.9 22.0 18.6 15.8 13.4	6	32.2 27.3 23.1 19.6 16.6	38.0 32.1 27.2 23.0 19.5	43.4 36.8 31.0 26.2 22.3	48.3 40.8 34.6 29.3 24.8		53.5 45.3 38.4 32.4 27.6	58.3 49.4 41.9 35.5 30.2
16 17 18 19 20	.051 .045 .040 .036 .032	4.54 3.85 3.26 2.76 2.32	8.28 7.02 5.95 5.04 4.27	11.35 9.60 8.13 6.88 5.83		14.1 12.0 10.1 8.60 7.30	16.5 14.0 11.8 10.1 8.53	18.9 16.0 13.6 11.55 9.70	21.0 17.8 15.1 12.8 10.8	3	23.4 19.8 16.8 14.2 12.0	25.6 21.7 18.4 15.6 13.2
21 22 23 24 25	.0285 .0254 .0226 .0201	1.67 1.42 1.20	3.62 3.07 2.60 2.20 1.86	4.94 4.18 3.54 3.00 2.54		6.17 5.23 4.43 3.75 3.18	7.23 6.13 5.19 4.40 3.73	8.21 6.96 5.90 5.00 4.25	6.6	30 51 50	10.2 8.65 7.33 6.20 5.27	11.2 9.46 8.02 6.80 5.76
26 27 28 29 30	.0159 .0142 .0126 .0113	.73 .62 .52	1.34 2 1.13 7 .96	1.82 1.54 0 1.30)5	2.70 2.28 1.85 1.57 1.33	3.16 2.68 2.27 1.93 1.64	3.61 3.06 2.62 2.22 1.89	3. 2. 2. 2.	36 86 45	4.47 3.80 3.23 2.71 2.30	4.88 4.13 3.50 2.97 2.52
31 32 33 34 35	.0089 .0080 .0071	.32 1 .27 3 .23	1 .57 2 .49 1 .41	7 .79 0 .6 6 .5	70	1.13 .95 .80 .68	9 1.00 5 .84	1.30	5 1. 5 1. 1.	50	1.95 1.66 1.41 1.18 1.00	2.14 1.81 1.53 1.29 1.09
36 37 38 39 40	.004	5 .14 0 .12 5 .10	$\begin{vmatrix} 1 & .25 \\ 0 & .21 \\ 1 & .18 \end{vmatrix}$.6 .2	44 91 46	.49 .41 .35 .29	6 .51 2 .44 8 .37	8 .50 0 .50 3 .41	97 07 30	765 650 552 463 396	.72 2 .61 7 .51	1 .783 3 .663 7 .566
	.0027 .0025 .0025 .0022 .002	5 .06 5 .05 .04	50 .10 50 .09 12 .0°	05 .1 91 .1 77 .1	45 22							
	.0015 .0012 .001	5 .02	.03	.0	71 51 35							

Resistance of Nichrome Ribbon

Specific resistance 530 ohms per square mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures. These figures are given as a basis for engineering calculations and represent average material as received.

Temp. Cent	20	100	200	300	400	500	600	700	800	900	1000°
Temp. Fahr	68	212	392	572	752	932	1112	1292	1472	1652	1832
Resis. in Ohm	1.000	1.006	1.029	1.047	1.057	1.072	1.077	1.082	1.088	1.095	

Resistance in Ohms Per Foot at 20° C. (68° F.)

Thi	ickness					Width-	-Inche	s			
B. & S.	In- ches	1/52	1/16	1/8	3/16	1/4	3/8	1/2	5/8	3/4	1
10 11 12 13 14 15	.102 .091 .081 .072 .064 .057				.0469	.0221 .0247 .0278 .0313 .0352 .0395	.0138 .0155 .0174 .0196 .0221 .0248	.0104 .0116 .0131 .0147 .0166 .0186	.0083 .0093 .0104 .0117 .0133 .0148	.0069 .0078 .0087 .0098 .0110 .0124	.0052 .0058 .0065 .0074 .0083
16 17 18 19 20	.051 .045 .040 .036 .032			.112 .125 .140	.0589 .0668 .0751 .0835 .0939	.0442 .0501 .0563 .0626 .0704	.0277 .0314 .0353 .0392 .0442	.0208 .0235 .0265 .0294 .0331	.0166 .0188 .0212 .0235 .0265	.0138 .0157 .0177 .0196 .0221	.0104 .0118 .0133 .0147
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		.451	. 158 . 178 . 199 . 225 . 251	.105 .118 .133 .150 .168	.0791 .0891 .0938 .106 .118	.0496 .0559 .0625 .0707 .0789	.0372 .0419 .0469 .0530 .0592	.0297 .0335 .0375 .0424 .0474	.0248 .0279 .0313 .0353 .0395	.0186 .0209 .0235 .0265 .0296
26 27 28 29 30	.0159 .0142 .0126 .0113 .010	1.80	.567 .635 .715 .798 .902	.283 .317 .357 .399 .451	.189 .211 .238 .301 .340	. 133 . 149 . 168 . 188 . 212	.0889 .100 .112 .125 .141	.0666 .075 .084 .094 .106	.0533 .060 .067 .075 .085	.0444 .050 .056 .063 .071	.0333 .037 .042 .047 .053
31 32 33 34 35	.0089 .008 .0071 .0063 .0056	2.02 2.25 2.54 2.86 3.22	1.01 1.12 1.27 1.43 1.61	.506 .638 .719 .810 .912	.382 .425 .479 .540 .608	. 239 . 265 . 298 . 336 . 378	.159 .177 .199 .224 .252	.119 .133 .149 .168 .189	.095 .106 .119 .135 .151	.079 .088 .100 .112 .126	.060 .067 .075 .084 .095
36 37 38 39 40	.005 .0045 .004 .0035 .0031	3.60 4.00 4.51 5.15 5.82	1.80 2.00 2.55 2.91 3.29	1.02 1.13 1.27 1.45 1.65	.681 .756 .851 .973 1.098	.424 .471 .530 .606 .684	.283 .314 .353 .404 .456	.212 .236 .265 .303 .342	.170 .188 .212 .242 .274	.141 .157 .177 .202 .228	.106 .118 .133 .151 .171

After careful investigation by a committee of the American Society for Testing Materials, working in conjunction with the U. S. Bureau of Standards, it has been found that the cross-sectional area of ribbon having rounded edges, depends upon the ratio of width to thickness, and is always less than a true rectangle having the maximum width and thickness of the ribbon.

Ribbon sizes $\frac{1}{4}$ " and $\frac{1}{16}$ " by .0253 and thicker and all ribbon narrower than $\frac{1}{16}$ " is rolled with round edges. The resistance of ribbon with round edges and having a ratio of width to thickness less than 15 to 1 is calculated on a cross section of 6% less than a true rectangle, while those sizes which have a ratio of width to thickness greater than 15 to 1 are calculated on a cross-section of 17% less than a true rectangle.

Unless otherwise specified material listed above will be supplied soft temper.

Nichrome Resistance Ribbon

Thic	kness			Width-	Inches		
No. B. & S.	Inches	1 64	1/32	1/16	1/8	3/16	½ to 2
24 25 26 27 28	.020 .018 .016 .0142 .0126			\$4_30 4_40 4_50 4_60 4_80	\$4,20 4,30 4,40 4,50 4,60	\$4.10 4.20 4.30 4.40 4.50	\$4_00 4_10 4_20 4_30 4_40
29 30 31 32 33	.0113 .010 .0089 .008	\$12.80 13.40	\$7.80 8.00 8.20 8.60	5,00 5,20 5,40 5,60 5,80	4.70 4.80 4.90 5.00 5.20	4 60 4 70 4 80 4 90 5 10	4 50 4 60 4 80 5 00 5 20
34 35 36 37 38	.0063 .0056 .005 .0045 .004	14.00 15.00 16.00 17.00 18.50	9.00 9.60 10.20 10.80 11.60	6-00 6-20 6-50 7-00 8-00	5 50 5 80 6 20 6 60 7 20	5.40 5.90 6.40 7.00 8.00	5.60 6.20 7.00 8.00
39 40	0035	20_50 23_00	12.80 14.50	10 00 12 00	9-00 11.00	10,00 12.00	

SPECIAL SIZES

Thickness Inches	Width 1/2" to 23/4"	Thickness Inches	Width 1/2" to 23/4"
.100 .090 .080 .070	\$3.40 3.40 3.40 3.40 3.40	.050 .040 .030 .020	\$3.50 3.60 3.80 4.00

Prices of "Nichrome" Ribbon of special dimensions furnished on request. Unless otherwise specified material listed above will be supplied soft temper.

A variety of waffle irons with "Nichrome" and "Nichrome" IV elements



Hot Rolled Nichrome

(For tolerances see page 55)

Strip

Specific resistance 530 ohms per square mil-foot. Since the cross sections are not true rectangles because of the rounded corners, the resistance figures in this table are 8% above the theoretical rectangular section. Approximate weight per cubic inch 0.3 lb.

Thick- ness Inches		Resistance, Ohms Per Foot						Approximate Weight Per Foot Figures are based on true rectangular sections at 0.3 lb. per cu. in.					
	Width—Inches						Width—Inches						
1	1/2	3/4	1	112	2	$\frac{1}{2}$	3/4	1	1 1/2	2			
1/2 7/16 3/8 5/16 1/4 3/16	.00266 .00311 .00373 .00466 .00621	.00155 .00178 .00207 .00249 .00311 .00414	.00116 .00133 .00155 .00186 .00233 .00311	.000776 .000888 .00104 .00124 .00155 .00207		.79 .67 .56 .45	1.35 1.17 1.01 .84 .67	1.35	2.34 2.05 1.68 1.35	3.60 3.16 2.70 2.24 1.80 1.36	\$2 .70		

Rounds, Squares, Hexagons and Octagons

The unit of weight is 0.30 lbs. per cu. in. In the case of 1" squares and smaller, the rounded corners will decrease the weight and increase the resistance per foot by about 3%. On larger squares, the error is approximately 6%. The following table is on this basis.

	Ro	ounds			Sc	luares	
Size Inches	Weight Per Foot	Ohms Per Foot	List Price Per Pound	Size Inches	Weight Per Foot	Ohms Per Foot	List Price Per Pound
1 ½ 1 3/8 1 1/4 1 1/8 1 3/4 5/6 1/2 7/16 3/8 5/16	6.36 5.34 4.41 3.57 2.83 1.59 1.12 .71 .54 .40 .28 .18	.000300 .000357 .000432 .000533 .000675 .00120 .00173 .00270 .00352 .00480 .00691 .01080	Prices on Appli- cation \$2.70	1 1/4 1 1/8 1 7/8 3/4 5/8 1/2 7/16 3/8 5/16	5.63 4.53 3.60 2.74 2.01 1.40 .90 .69 .51 .35	.000361 .000445 .000546 .000713 .000971 .001400 .002190 .002854 .003885 .005595 .008742	\$2.70 2.70

For Prices of Hexagons and Octagons use list prices of Squares.

Nickel, Advance, Comet and other special alloys can be supplied in these shapes and sizes.

Unless otherwise specified material listed above will be supplied soft temper.

Suggestions on Design of Nichrome Heating Elements

The tables below give size of "Nichrome" suggested for a given number of watts at 110 volts. The sizes are selected to operate at approximately 1500°F. in open coils and are suitable for electric irons, toasters, hot plates, space heaters, etc.

Nichrome Wire. 110 Volts

Watts	Amperes	B. & S. Size	Ohms 75° F	Leng	Length		
250 300 350 400 450	2.27 2.72 3.2 3.64 4.10	25 24 23 23 23 22	43.6 36.4 31.0 27.2 24.1	21 Ft. 22 24 21 23	2 Ins 0 0 0 5		
475 500 550 575 600	4 .32 4 .55 5 .0 5 .23 5 .46	22 22 21 21 21	23.0 21.8 19.8 18.9 18.1	22 21 24 23 22	4 0 5 2 4		
615 640 660 700 750	5.6 5.82 6.0 6.36 6.81	20 20 20 20 20 19	17.7 17.0 16.5 15.6 14.5	27 26 25 24 28	6 6 8 4 5		

Nichrome Ribbon. 110 Volts. 1/6" Width

Watts	Amperes	Thickness	Ohms 75° F	Length	
400 425 440 450 475	3 64 3 87 4 00 4 1 4 32	.003 .0035 .0035 .004 .0045	27 . 2 25 . 6 24 . 7 24 . 1 22 . 9	9 Ft. 10 10 11 12	10 Ins 9 5 7 5
500 525 550 575 600	4.55 4.77 5.0 5.23 5.46	.0045 .005 .005 .0056	21.8 20.8 19.8 18.9 18.1	11 12 11 12 12	8 6 11 10 3
625 650 660 675 700 750	5.68 5 91 6 00 6.15 6 36 6 82	.0063 .0071 .0071 .008 .008	17 . 4 16 . 7 16 . 5 16 . 1 15 . 6 14 . 5	12 13 13 15 14 15	11 11 10 0 7

Suggestions on Design of Nichrome Heating Elements

For voltages other than 110 divide the number of watts required at the given voltage by the voltage factor below. Select the nearest number of watts in the 110 volt table, multiply the length in 110 volt table by the voltage factor. Suppose an electric iron takes 550 watts and the

supply voltage is 100. Factor for 100 volts is .91 and $\frac{550}{.91}$ = 605 watts.

Nearest value in 110 volt table is 600 watts which requires 12' 3" of $\frac{1}{16}$ x .0056 "Nichrome" ribbon. This gives the size to be used on 110 volts, but the length should be .91 x 12'3" or 11'2". The winding for 550 watts, 110 volts would then be 11'2" of $\frac{1}{16}$ x .0056 "Nichrome" ribbon.

Voltage Factors on Basis of 110 Volts

Voltage	100	120	150	200	220	240	32
Factor	.91	1.09	1.36	1.82	2_0	2.18	0 29

Element arrangements of "Nichrome" and "Nichrome" IV



No. 95 Alloy

O. 95 Alloy is a copper-nickel alloy developed by the Driver-Harris Company particularly for use on radio rheostats where high carrying capacity combined with fairly high resistance is essential.

This alloy is melted and processed in the Driver-Harris plant with the same care and precision as is given to their other highly specialized alloys.

Commercial and domestic toasters-"Nichrome" and "Nichrome" IV

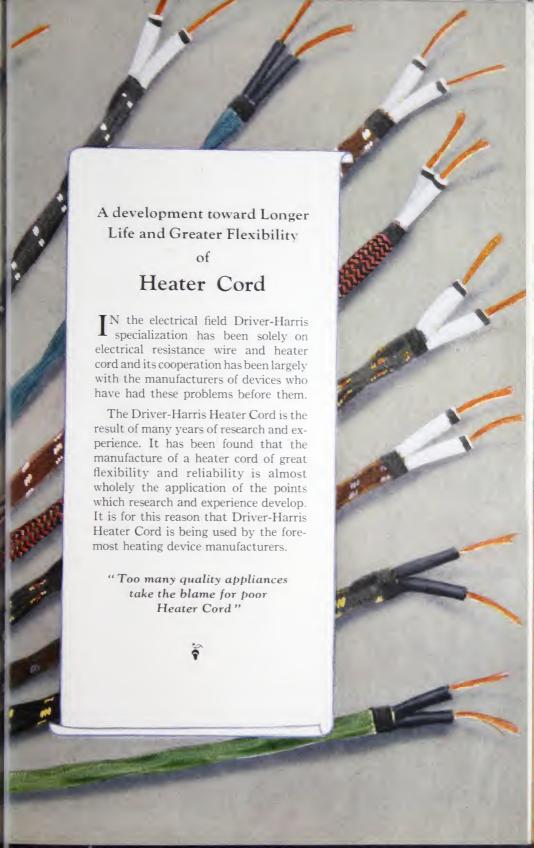


No. 95 Alloy

Specific Resistance 95 ohms per circular mil-foot at 20° C. $(68^{\circ}$ F.). Temperature coefficient over the range of 15° to 100° C. $(59^{\circ}$ to 212° F.) is + .00045 per degree C. Thermal E. M. F. against copper not over .027 millivolts per degree centigrade between 0° and 100° C.

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20° C. (68° F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Foot Bare Wire	List Price Per Pound Bare Wire
15	.057	.0292	9.2	109	3.18	\$1.48
16	.051	.0365	7.2	139	5.07	1.51
17	.045	.0469	5.6	179	8.39	1.55
18	.040	.0593	4.42	226	13.4	1.60
19	.036	.0733	3.58	279	20 4	1.65
20	.032	.0927	2.83	353	32.7	1.70
21	.0285	.1169	2.24	446	52.1	1_75
22	.0254	.1472	1.77	565	83.1	1_80
23	.0226	.1859	1.41	709	131.8	1.85
24	.0201	. 234	1.12	893	208.9	1 90
25	.0179	.296	0.89	1,123	332	2.00
26	.0159	.375	0.70	1,429	535	2.10
27	.0142	. 471	0.56	1,786	841	2.25
28	.0126	.598	0_44	2,273	1.359	2.40
29	.0113	.743	0.35	2,857	2,122	2.55
30	.0100	.950	0.276	3,623	3,440	2,70
31	.0089	1.199	0.219	4,566	5,470	2.90
32	.0080	1.484	0_177	5,656	8,390	3 10
33	.0071	1.884	0.139	7,194	13,500	3.30
34	. 0063	2.393	0.110	9,091	21,750	3.70
35	.0056	3.029	0.087	11,490	34.800	4.50
36	.0050	3.800	0.069	14,490	55,000	5.50
37	.0045	4.691	0.056	17,860	82,000	7.00
38	.0040	5.937	0.045	22,220	131,900	9.00
39	.0035	7.755	0.034	29,410	228,000	12.00
40	.0031	9.885	0.025	40,000	395,000	16.00





Types

A—Two conductors twisted and braided over all with finishing braid. B-Individual conductors covered with a finishing braid and then

twisted (twisted pair).

-Two conductors laid parallel and braided over all with the finishing braid.

Asbestos Construction

To meet the requirements of various manufacturers our heater cord is supplied in various types of asbestos constructions, designated as follows: B-Conductors insulated with rubber, braided with asbestos yarn and

covered with finishing braid.

V—Conductors insulated with rubber, wound with asbestos roving and covered with finishing braid.

Our method of applying roving renders it unnecessary to use cotton leaders, thereby obtaining maximum insulating qualities. S-Conductors insulated with rubber, wound with asbestos yarn and

covered with finishing braid.

R—Conductors covered with asbestos first then insulated with rubber and covered with finishing braid.

Copper Construction

Conductors can be supplied in any of the following constructions:

J-.010 Copper stranded L-.0063 Copper braided M - .005

K = .0063N-.005 Copper stranded

Finish

Any color or combination of colors can be furnished in the following finishes, including combinations of cotton and silk.

1—Mercerized cotton 2—Glazed " (peeler) 3—Soft

4—Pure Floss Silk 5—Worsted

6-Rayon

These designations facilitate ordering, for example:

No. 18 AVI-No. 2 and 6-Black and Green

This represents the following:

Size—No. 18

Type—A (two conductors under one finishing braid)
Asbestos—V (wound with asbestos roving)
Copper—J (.010" stranded)
Finish—2 and 6 (part glazed cotton and part rayon)

Color—Black cotton and green rayon

Marker

Driver-Harris quality heater cord can be easily identified by a marker which consists of two threads, one blue and one white, laid parallel with

the copper. Heater cord is usually furnished in coils of long length. We have facilities, however, for furnishing cords cut to length with ends finished. Orders for finished cords must be accompanied by complete specifications.



—a good heater cord increases respect for the appliance. D-H cord is the Better Heater Cord.

Advance

NICKEL and Copper have been scientifically combined in the Driver-Harris alloy "Advance" (Ideal), with the result that a resistance material of unusual properties and characteristics has been obtained. While this alloy finds most important application for industrial and radio rheostats, motor starters, etc., it is preeminently useful to the manufacturers of measuring instruments and precision equipment.

Its non-corrosive quality and unvarying resistance with changing temperatures over practical ranges has caused its selection for these precision purposes. As a matter of fact, the change in resistance with change in temperature cannot be detected within operating temperatures of the applications mentioned above, without the most delicate

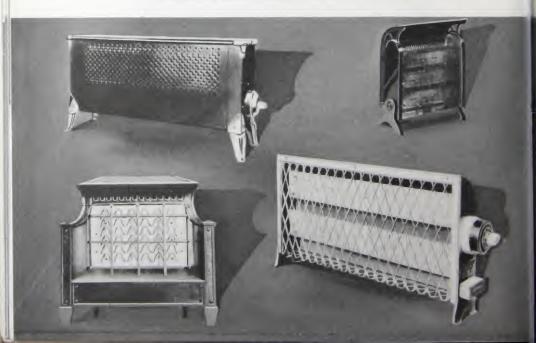
and sensitive laboratory equipment.

This alloy, prepared by Driver-Harris precision methods, is one of the most valuable thermo-electric materials on the market for thermo elements. It is used particularly by pyrometer manufacturers whose reputations are based upon the quality and accuracy of their equipment.

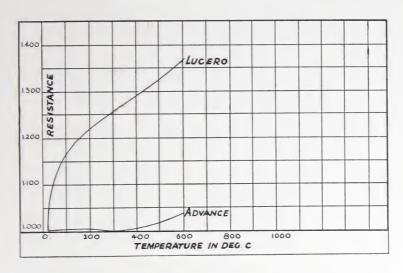
This material is made to their exact thermo-electric specifications and therefore orders for "Advance" for thermo-electric purposes should be sent to the pyrometer

manufacturer whose calibrations are involved.

Radiators equipped with "Nichrome" or "Advance"



Temperature Resistance Chart Advance and Lucero



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

"Advance" or "Nichrome" wire are the favorites for heater pads



Advance Resistance Wire

Specific resistance 294 ohms per circular mil-foot at 20°C. (68°F.). The change of resistance with change of temperature is negligible.

Thermal E. M. F. against copper is approximately 0.043 millivolts per degree Centigrade, between 0°C. and 100°C. For temperature resistance chart see page 39.

Factors to be used in determining resistance at elevated temperatures

Tem		ade	20 68	100 212	200 392	300 572	400 752	500 932	
Resi	stance in	Ohms	1.000	1.002	1-002	1.001	1.005	1.01	7 1.037
No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20 C. (68 F.)	Weigh Per 1000 F Bare W Pound	ire	Feet Per Poun Bare Wir		Ohms Per Pour Bare Wi		List Price Per Pound Bare Wir
1 2 3 4 5	289 258 229 204 182	-003 .004 .005 .007 .008	253 0 201 0 159 0 126 0 100 0)		94		0136 0217 0346 0549 0874	\$1.30 1.30 1.30 1.30 1.30
6 7 8 9	162 144 1285 114 102	011 014 017 022 028	79.0 63.0 50.0 39.0 32.0)))	20 25	7 9 .0 .6 .3		. 139 . 221 . 351 . 559 . 888	1.30 1.30 1.30 1.32 1.34
11 12 13 14 15	091 081 072 064 057	.035 .044 .056 .071 .090	25 (20 (15 1 12 9	7	50 63	0.0 0.0 3.7 0.6 2.0	2 3 5	41 246 573 .678 .03	1.36 1.39 1.42 1.45 1.48
16 17 18 19 20	051 -045 -040 -036 -032	-113 -145 -184 -226 -287	7 6 4 3 3	2 9 9		0	22 36 57	.36 .83 .29 .71 .74	1 .51 1 .55 1 .60 1 .65 1 .70
21 22 23 24 25	0285 0254 0226 0201 0179	.362 .460 .575 .725	2- 1 1. 1- 0.	9 5 2	520 66	0.0 6.0 7.0 3.0 1.0	23 36 58	5.9 2.0 9.0 66 6 82 9	1.75 1.80 1.85 1.90 2.00
26 27 28 29 30	.0159 .0142 .0126 .0113 .0100	1 162 1 455 1 850 2 300 2 940	0 0	77 61 48 38 30	1,29 1,63 2,08 2,63 3,33	9.0 3.0 2.0	1,48 2,35 3,74 5,96 9,47	58 19 54	2.10 2.25 2.40 2.55 2.70
31 32 33 34 35	0089 0080 0071 0063 0056	3 680 4 600 5 830 7 400 9 360	0.0	24 19 15 12 095	4,16 5,26 6,66 8,33 10,53	3 0 7.0 3 0	15,0° 23,9° 38,1° 60,6° 96,3°	70 10 20	2 90 3 10 3 30 3 70 4 50
36 37 38 39 40	0050 -0045 -0040 -0035 -0031	11 760 14 550 18 375 24 100 30 593	0 0	076 060 047 038 .028	13,16 16,66 21,27 26,31 35,71	6 0 6 0	153,2 243,6 388,3 616,0 1,092,5	50 60 00	5.50 7 00 9.00 12.00 16.00
	.00275 .0025 .00225 .002 .00175	-38 888 46.400 58.103 72.500 96.078 130.666	0 0 0 0	.021 017 014 .011 .008 .006	47,60 58,90 71,50 91,00 125,00 166,60	00.00	1,850,0 2,730,0 4,150,0 6,600,0 12,000,0 21,600,0	00 00 00 00	21 00 27 00 35 00 45 00 60 00 80 00

Unless otherwise specified material listed above will be supplied soft temper. Prices of Cotton and Silk Covered Wires furnished on request.

Current Temperature Characteristics of Advance Resistance Wire

Showing amperes necessary for a given temperature. Applying only to straight wires stretched horizontally in free air.

	Diam.	100	200	300	400	500	600° C.
No. B. & S.	in Inches	212	392	572	752	932	1112° F.
1	. 289	82.6	154 0	215.0	268 0	310 0	394.0
2	. 258	70.0	130 0	182.0	227 0	263 0	334.0
3	. 229	59.4	110 0	154.0	193 0	223 0	283.0
4	. 204	50.3	93 5	130.0	164 0	189 0	240.0
5	. 182	42.6	79 2	110.0	139 0	160 5	203.0
6 7 8 9	. 162 . 144 . 1285 . 114 . 102	36.1 30.6 25.9 22.0 18.6	67_1 57_0 48_3 40_8 34_6	93.5 79.2 67.1 57.0 48.3	118 0 100 0 84 5 71 5 60 6	136 0 115 0 97 5 82 6 70 0	172 0 146 0 124 0 105 0 89 1
11	.091	15.8	29 3	40 8	51 4	59 4	75.5
12	.081	13.4	24 8	34 6	43 5	50 3	64.0
13	.072	11.35	21 0	29 3	36 8	42 6	54.2
14	.064	9.60	17 8	24 8	31 2	36 1	45.9
15	.057	8.13	15 1	21 0	26 4	30 6	38.9
16	.051	6.88	12 8	17 8	22 4	25_9	33 0
17	.045	5.83	10 85	15 1	19 0	22_0	28 0
18	.040	4.94	9 20	12 8	16 1	18_6	23 8
19	.036	4.18	7 80	10 85	13 6	15_8	20 2
20	.032	3.54	6 61	9 20	11 50	13_4	17 1
21	.0285	3 00	5 60	7.80	9 77	11 35	14 5
22	.0254	2 54	4 67	6.61	8 28	9 60	12 3
23	.0226	2 15	3 96	5.60	7 02	8 13	10 4
24	.0201	1 82	3 36	4.67	5 95	6 88	8 80
25	.0179	1 54	2 86	3.96	5 04	5 83	7 45
26	0159	1 305	2 45	3 36	4 27	4 94	6 31
27	0142	1 105	2 08	2 86	3 62	4 18	5 35
28	0126	0 935	1 77	2 45	3 07	3 54	4 54
29	0113	0 791	1 50	2 08	2 60	3 00	3 85
30	0100	0 670	1 23	1 77	2 20	2 54	3 2 6
31	0089	0 567	1 06	1 50	1 86	2 15	2 76
32	0080	0 480	0 90	1 28	1 58	1 82	2 32
33	0071	0 406	0 765	1 06	1 34	1 54	1 97
34	0063	0 344	0 650	0 90	1 13	1 305	1 67
35	0056	0 291	0 552	0 765	0 960	1 105	1 42
36	0050	0 246	0 467	0 650	0 814	0_935	1 20
37	-0045	0 208	0 396	0 552	0 680	0_791	1 02
38	-0040	0 176	0 335	0 467	0 577	0_670	0 863
39	-0035	0 149	0 284	0 396	0 490	0_567	0 734
40	-0031	0 126	0 240	0 335	0 416	0_480	0 623

Resistance of Advance Ribbon

Specific resistance 231 ohms per square mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

Temp. Centigrade Temp. Fahrenheit		100 212	200 392	300 572	400 752	500 932	600° 1112°
Resistance in Ohms	1.000	1.002	1.002	1.001	1.005	1.017	1.037

Resistance in Ohms Per Foot at 20° C. (68° F.)

Thick	kness				Width-	-Inches			
No. B. & S.	Inches	1/16"	1/8′′	8/16"	1/4"	3/8"	1/2"	3/4"	1''
14	. 064						.0072	.0048	. 0036
15	.057						.0081	.0054	.0040
16	.051	=				1	.0091	.0061	.0045
17	.045						.0103	.0069	.0051
18	.040						.0115	.0077	.0058
19	.036						.0128	.0086	.0064
20	.032	. 122	.0614	.0409	.0307	.0192	.0144	.0096	.0072
21	.0285	.137	.0689	.0459	.0344	.0216	.0162	.0108	.0081
22	.0253	. 155	.0777	.0518	.0388	.0243	.0183	.0122	.0091
23	.0226	.173	.0869	.0579	.0410	.0272	.0204	.0136	.0102
24	.020	. 196	.0982	.0655	.0450	.0307	.0230	.0154	.0115
25	.0179	.219	.1098	.0732	.0516	.0344	.0258	.0172	.0129
26	.0159	247	.1236	.0824	.0580	.0387	.0290	.0194	.0145
27	0142	.276	.1384	.0922	.0650	. 0435	.0326	.0218	.0163
28	.0126	.312	.1560	. 104	.0735	.0490	.0367		
29	.0113	.347	.1739	. 131	.0820	.0545	.0410		
30	.010	.393	. 1965	. 148	.0925	.0616	.0462		
31	.0089	.441	.2208	.166	.1040	.0693			
32	.008	. 491	.2783	. 185	.1155	.0770			
33	.0071	553	.3135	.209	.1300	.0870			
34	.0063	.624	. 3534	.235	.1470	0989			
35	.0056	. 702	. 3975	.265	.1650	.1100			
36	.005	.786	. 4453	.296	.1850	.1230			
37	.0045	.873	. 4947	.329	.2060	.1370			12.10
38	.004	1.113	. 5566	.371	.2310	.1540			
39	.0035	1.272	.6361	. 424	.2640	.1760			
40	.0031	1.436	.7182	.478	.3080	.2050			

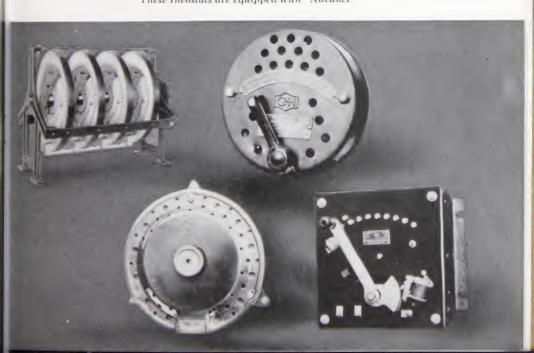
Unless otherwise specified material listed above will be supplied soft temper. For weights of this alloy refer to page 62.

List Price Per Pound of Advance Resistance Ribbon

Thic	kness			Width-	-Inches		
No. B. & S.	Inches	148	18	346	1/4	3/8	½ to 2¾′
20 21	.060	\$2.25	\$2.05	\$2.05	\$1.85	\$1.85	\$1.65
	.050	2.30	2.10	2.10	1.90	1.90	1.70
	.040	2.35	2.15	2.15	1.95	1.95	1.75
	.032	2.40	2.20	2.20	2.00	2.00	1.80
	.0285	2.45	2.25	2.25	2.05	2.05	1.85
22	.0253	2 50	2 30	2 30	2 10	2 10	1_90
23	.0226	2 55	2 35	2 35	2 15	2 15	1.95
24	.0201	2 60	2 40	2 40	2 20	2 20	2.00
25	.0179	2 70	2 50	2 50	2 30	2 30	2.05
26	.0159	2 80	2 60	2 60	2 40	2 40	2.10
27	.0142	2.90	2.70	2.70	2.50	2 50	2.20
28	.0126	3.00	2.80	2.80	2.60	2 60	2.30
29	.0113	3.10	2.90	2.90	2.70	2 70	2.40
30	.010	3.20	3.00	3.00	2.80	2 80	2.50
31	.0089	3.30	3.10	3.10	2.90	2 90	2.60
32	.008	3.40	3.20	3.20	3.00	3 00	2 80
33	.0071	3.50	3.30	3.30	3.20	3 20	3 00
34	.0063	3.70	3.50	3.50	3.40	3 40	3 20
35	.0056	3.90	3.70	3.70	3.60	3 60	3 40
36	.005	4.20	4.00	4.00	3.90	3 90	3 70
37 38 39 40	.0045 .004 .0035 .003	4.50 5.10 6.10 7.60	4.40 5.10 6.10 7.60	4, 40 5, 10	4 30 5.00	4-30 5.00	4.20 5.00

Prices of Advance Ribbon of Special Dimensions furnished on request. Unless otherwise specified material listed above will be supplied soft temper.

These rheostats are equipped with "Advance"



Lucero

"LUCERO", an inexpensive Nickel-Copper alloy, has an ever widening field of application due to its adaptability for wire and strip requirements where strength and non-corrosive characteristics are needed to produce a superior product.

"Lucero", it will be noted, has a higher specific resistance than German or Nickel Silver and is far more permanent.

As this alloy contains no zinc, it is absolutely reliable and will neither break down structurally nor become brittle

For fashioning metals-



under repeated heating and cooling. It may be operated continuously at temperatures up to 600° C. (1112° F.) without oxidation taking place.

"Lucero" will take a brilliant luster finish resembling platinum. It is widely used by the general trade using wire and strip in their product.

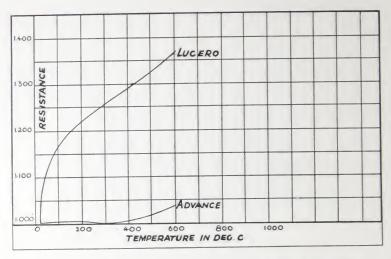
This alloy eliminates the necessity of nickel plating wire or strip and has the added advantage of greater strength than iron, brass, copper or similar metals.

"Lucero" frequently finds useful application when a non-corrosive spring metal is desired.





Temperature Resistance Chart Lucero and Advance



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

Table stoves or grills-"Nichrome" or "Nichrome IV" elements



Lucero Resistance Wire

Specific resistance 256 ohms per circular mil-foot at 20°C. (68°F.). For temperature resistance chart see page 46.

Factors to be used in determining resistance at elevated temperatures

	np. Centig np. Fahre		20 68	100 212	200 392	300 572		400 752	500 932		600° 1112°
Res	istance in (Ohms	1.000	1.165	1.220	1.257	1.	270	1.323	1	1.363
No. B. & S.	Diam. in Inches	Per at 2	nms r Ft. 20°C.	Weight Per 1000 Ft. Bare Wire Pounds	Per l	eet Pound Wire		Ohr Per Po Bare V	ound	F	t Price Per Pound e Wire
1 2 3 4 5	.289 .258 .229 .204 .182	. (0031 0039 00495 00625 00785	252. 202. 159. 126. 100.		3.96 4.95 6.30 7.93 10.0			.0135 .0210 .0334 .053 .085		
6 7 8 9 10	.162 .144 .128 .114 .102	. (0099 0125 0159 020 025	79.5 62.5 49.5 38.8 31.4		12.6 16.0 20.2 25.7 31.8			.135 .216 .345 .555 .858		1 .29 1 .31 1 .32
11 12 13 14 15	.091 .081 .072 .064 .057	. (0314 040 050 063 080	25.0 19.8 15.7 12.4 9.8		40.0 50.4 63.7 82.0 102			1 36 2 16 3 44 5 57 8 77		1 .33 1 .36 1 .38 1 .40 1 .43
16 17 18 19 20	.051 .045 .040 .036 .032		100 128 162 200 254	7.8 6.1 4.8 3.9 3.1		128 163 207 256 323		2 3 5	3 8 1.5 6.2 5 3 8.3		1.46 1.49 1.51 1.55 1.60
21 22 23 24 25	.0285 .0253 .0226 .020 .0179		320 406 510 549 311	2.48 1.94 1.54 1.26 .965	1	407 515 648 823 035		14 22 35 57 90	5 6 6		1.64 1.69 1.73 1.79 1.83
26 27 28 29 30	.0159 .0142 .0126 .0113	1.0 1.2 1.0 2.0 2.0	29 64 04	.763 .610 .460 .385 .302	1 2 2	310 640 ,170 ,600 ,300		1,45 2,28 3,84 5,72 9,24	0 0 0		1.87 1.90 1.94 1.98 2.01
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	3.2 4.0 5. 6.1 8.3	06 17 56	.239 .194 .154 .120 .095	5 6 8	,175 ,150 ,550 ,330 ,500		14,80 22,60 36,50 59,00 94,00	0 0 0		2 .03 2 .09 2 .23 2 .42 2 .59
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	10.4 12.8 16.2 21.2 27.	2	.075 .061 .048 .037 .029	16 20 27	300 300 600 000 500	3	149,00 225,00 360,00 518,00 010,00	0 0 0		3.00 3.58 4.68 6.33 9.49

Unless otherwise specified material listed above will be supplied soft temper.

For weights of this material refer to page 61.

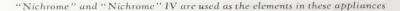
Prices of above material in ribbon form furnished on request.

Manganin

MANGANIN is an alloy of copper, manganese and nickel. By carefully controlling the manufacture of this alloy, it is possible to obtain material with an exceedingly low temperature coefficient. When the finished material is properly stabilized the resistance of Manganin does not change with age.

The thermal electromotive force against copper is negligible, which is of importance in minimizing the effect of differences in temperature in the electric circuit and makes Manganin wire ideal for Wheatstone bridges and other precision instruments.

The principal use of this material is in the form of sheet for electrical instrument shunts and wire for precision multipliers and standard coils.





Manganin Resistance Wire

Specific resistance 290 ohms per circular mil-foot at 20°C. (68°F.). Temperature coefficient over the range of 15° to 35°C. (59° to 95°F.), with the peak of the curve at 25°C. (77°F.), will be between .00002 and .000005 per degree C. Thermal E.M.F. against copper not over 0.003 millivolts per degree centigrade, between 0°C. and 100°C.

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire	List Price Per Pound Bare Wire
15	.057	.089	9_2	109.0	9.70	\$1.97
16	.051	.110	7.2	139.0	15 29	2.01
17	.045	.142	5.6	179.0	25.4	2.07
18	.040	.180	4.42	226.0	40-6	2.13
19	.036	.218	3.58	279.0	60.82	2.20
20	.032	. 282	2_83	353.0	99_5	2.27
21	.0285	.356	2_24	446.0	158	2.33
22	.0254	. 452	1-77	565.0	255	2 40
23	.0226	.567	1.41	709.0	402	2.47
24	.0201	.717	1.12	893.0	704	2.53
25	.0179	. 905	0.89	1,123.0	1,016	2 67
26	.0159	1.147	0.70	1,429 0	1,639	2.80
27	.0142	1.438	0_56	1,786.0	2,568	3.00
28	.0126	1.825	0_44	2,273.0	4,148	3.20
29	.0113	2.270	0.35	2,857.0	6,485	3.40
30	.0100	2.899	0.276	3,623 0	10,503	3.60
31	.0089	3.661	0.219	4,566.0	16,716	3,87
32	.0080	4.531	0.177	5,656.0	25.627	4.13
33	.0071	5.753	0.139	7,194.0	41,387	4.40
34	.0063	7.304	0_110	9,091.0	66,400	4.93
35	.0056	9.234	0.087	11,490.0	106,098	6.00
36	.0050	11.599	0.069	14,490.0	168,069	733
37	.0045	14 352	0.056	17,860.0	256,326	9.33
38	.0040	18.120	0-045	22,220.0	402,626	12.00
39	.0035	23.767	0.034	29,410.0	698,987	16.00
40	.0031	32_220	0.025	40,000.0	1,288,800	21 33

Unless otherwise specified material listed above will be supplied soft temper.

Prices of Cotton and Silk Covered Wires furnished on request. Manganin is also furnished in ribbon and strip.

Pure Nickel

D-H Quality

PRIVER-HARRIS Quality Pure Nickel is supplied in round sizes from .001 to heavy machine rods and in any dimensions of cold rolled sheet and cold rolled strip up to 24 inches wide.

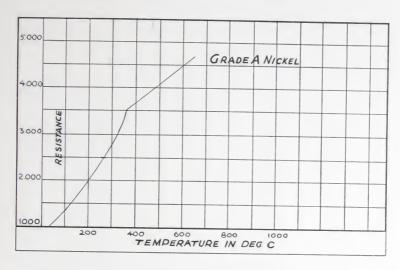
D-H Quality Pure Nickel represents the maximum refinement of this metal in its purest commercial state and is supplied to customers after an accurate study of the exact requirements of the trade. The common applications of this material are resistance thermometers and various parts in incandescent and radio lamp manufacture. D-H Quality Pure Nickel is easy to keep clean, immune to rust and corrosion with no protective coating to chip or wear and therefore lasts indefinitely. It is also used in many instances for decorative purposes because of its beautiful platinum white color, the finish which it will take, and its non-corrosive properties.

D-H Quality Pure Nickel is particularly close-grained and tough and has been applied on many applications purely on account of its physical properties.



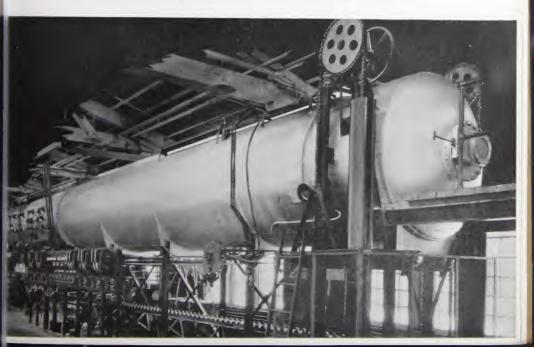


Temperature Resistance Chart Pure Nickel Wire



The above chart shows change in resistance of 1 ohm of wire with increasing temperature.

Continuous brazing furnace equipped with "Nichrome" IV elements



Pure Nickel Wire

D-H Quality

Specific resistance 58 ohms per circular mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

Temp. Cer Temp. Fal	ntigrade nrenheit	20 68	100 212	200 392	300 572	400 752	500 932	
Resistance		1.000	1.35	2.00	2.80	3.70	4.10	4.48
No. B. & S.	Diam. in Inches	Per	ms Ft.	Weigh Per 1000 F Bare W Pound	t. ire	Feet Per Pou Bare W		List Price Per Pound Bare Wire
1 2 3 4 5	.289 .258 .229 .204 .182	.0	00694 00871 0110 0139 0175	253.0 201.0 159.0 126.0 100.0		4 6 7 10	.95 .98 .29 .94	\$1.50 1.50 1.50 1.50 1.50
6 7 8 9	.162 .144 .1285 .114 .102	0.0	0221 0280 0354 00445 00557	79.0 63.0 50.0 39.0 32.0		15 20 25	7 5.9 5.6 3	1.50 1.50 1.50 1.52 1.54
11 12 13 14 15	.091 .081 .072 .064	0.	00700 00883 01118 01415 01785	25.0 20.0 15.7 12.4 9.8		50 63	0.0 0.0 3.7 0.6 2.0	1.56 1.59 1.62 1.65 1.68
16 17 18 19 20	.051 .045 .040 .036 .032	. ()2228)2864)362)447)566	7.8 6.2 4.9 3.9 3.1		204 256	1.0	1.71 1.75 1.80 1.85 1.90
21 22 23 24 25	.0285 .0254 .0226 .0201	. (0714 0905 1135 1435 1809	2.5 1.9 1.5 1.2 0.9		520 66'	0.0 6.0 7.0 3.0 1.0	1.95 2.00 2.05 2.10 2.20
26 27 28 29 30	.0159 .0142 .0126 .0113 .0100		2293 2876 365 454 579	0 7 0 6 0 4 0 3 0 3	8 8 8	1,29 1,63 2,08 2,63 3,33	9.0 3.0 2.0	2.30 2.45 2.60 2.75 2.90
31 32 33 34 35	.0089 .0080 .0071 .0063 .0056	1.1	732 905 15 45 84	0.2 0.1 0.1 0.1	9 5 2	4,16 5,26 6,66 8,33 10,53	3.0 7.0 3.0	3.10 3.30 3.50 3.90 4.70
36 37 38 39 40	.0050 .0045 .0040 .0035 .0031	3.	31 87 62 75 44	0.0	060	13,16 16,66 21,27 26,31 35,71	67_0 76.0 16.0	5.70 7.20 9.20 12.00 16.00
- 10	.00275 .0025 .00225 .002	5 11 14	.49	0.0	021 017 014 011 008	47,60 58,90 71,50 91,00 125,00	00 0 00 0 00 0	21.00 27.00 35.00 45.00 60.00
	.0015	25		0.	006	166,66	66.0	80.00

For weights of this material refer to page 61.
Unless otherwise specified material listed above will be supplied soft temper.
Prices of Cotton and Silk Covered Wires furnished on request.
Pure Nickel is also furnished in Ribbon, Strip and Sheet.
For prices of Manganese Nickel add 5c. net to pure Nickel net.

Cold Rolled Pure Nickel

D-H Quality

Ribbon, Strip and Sheet

		Ril	obon	and	Strip					S	heet		
Thi	ckness		1	Vidth-	-Inche	es.				Width	—Incl	nes	
No. B. & S.	In- ches	1/16	1/8	3 16	14	3.8	1/2 to 23/4	Thick	3 to 4	4 ¹ 16 to 7	7 ¹ / ₁₆ to 12	12 ¹ ₁₆ to 18	
20 21	.060 .050 .040 .032 .0285			\$2 40 2 45				. 187 . 156 . 125	\$1.48 1.48 1.51 1.52		\$1 49 1 49 1 52 1 53	1.55	\$1.48 1.48 1.53
22 23 24 25 26	.0253 .0226 .0201 .0179 .0159	2.70 2.75 2.80 2.90 3.00	2.70	2 55 2 60 2 70	2 . 30 2 . 35 2 . 40 2 . 50 2 . 60	2.38 2.40 2.50	2.15 2.20 2.25	.081 .078 .072	1.53 1.53 1.55 1.56 1.60	1 59 1 61 1 61 1 61 1 64	1.57 1.60 1.60 1.60	1.61 1.61 1.62	1.56 1.57 1.57 1.59
27 28 29 30 31	.0142 .0126 .0113 .010 .0089	3 10 3 20 3 30 3 40 3 50	2 90 3 00 3 10 3 20 3 30	3.00 3.10 3.20	2.70 2.80 2.90 3.00 3.10	2.70 2.80 2.90 3.00 3.10	2.50 2.60 2.70		1.60 1.61 1.62 1.64 1.66	1 65 1 66 1 67	1.65 1.67 1.69 1.70 1.75	1.66 1.67 1.69	1 . 64 1 . 66 1 . 66 1 . 66
32 33 34 35 36	.008 .0071 .0063 .0056	3.60 3.70 3.90 4.20 4.30	3.40 3.50 3.70 3.90 4.20	3.50	3.20 3.40 3.60 3.80 4.10	3.20 3.40 3.60 3.80 4.10	3.20 3.40 3.60	.032 .030 .0285 .025 .0225	1.69 1.69 1.71 1.71 1.72	1.73 1.75 1.76 1.79	1 78 1 81 1 86 1 86 1 86	1.72 1.76 1.76	1.70 1.70 1.74 1.74 1.85
37 38 39 40	.0045 .004 .0035 .003	4.70 5.30 6.30 7.80	4.60 5.30 6.30 7.80	4 60 5 30	4 50 5 20	4.50		.020	1.73	1.79	1 88	1.82	1.85
	0025 00225 00225 002 00175 0015 00125 001						11.60 16.30 20.95 28.35 46.50 55.85 70.00	r pour	nd.				

Comet

"COMET" (193 Alloy) is a nickel-chromium-iron alloy, whose chromium content renders it resistant to oxidation in devices operating from low to medium temperatures.

It is an inexpensive material and due to low cost and high resistance is used extensively in elevator and crane controllers, and in heavy duty rheostats.

Properties of Comet Resistance Wire

Specific resistance 550 ohms per circular mil-foot at 20°C. (68°F.).

Factors to be used in determining resistance at elevated temperatures

6.4	Fahren	adeheit	20 68	100 212	200 392	300 572	400 752	500 932	600 1112	700 1292	800 1472	900 1652
Resi	stance in (Ohms	1,000	1.086	1.197	1.292	1.365	1.425	1.473	1.504	1.538	1_585
No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20° C (68° F)	1000 Bare	ight Per O Ft. Wire unds		Feet Per Por Bare W	und		Ohmer Pou	ınd	Pe	Price Per ound Wire
1 2 3 4 5	. 289 . 258 . 229 . 204 . 182	.006 .008 .010 .013 .016	184 141 11	1.0 4.0 5.0 5.0 2.0			4.33 5.43 6.90 8.70 10.9			.029 .043 .069 .110 .173		\$1.60 1.60 1.60 1.60 1.60
6 7 8 9	. 162 . 144 . 1285 . 114 . 102	.021 .026 .033 .042 .052	5 4 3	3.0 7.0 5.0 6.0 9.0			13.7 17.5 22.2 27.8 34.5			.276 .447 .719 1.13 1.73	7	1.60 1.60 1.60 1.62 1.64
11 12 13 14 15	.091 .081 .072 .064	.066 .083 .106 .134	1	3.0 8.0 4.3 1.3 9.2			43.5 55.6 69.9 88.5 09.0			2.82 4.47 7.19 11.4 17.7		1.66 1.69 1.72 1.75 1.78
16 17 18 19 20	.051 .045 .040 .036 .032	.211 .271 .343 .424 .537		7.2 5.6 4.42 3.58 2.83		1 2 2	39.0 .79.0 226.0 279.0 353.0		1	28.3 46.6 74.5 13.0 82.0		1.81 1.85 1.90 1.95 2.00

Unless otherwise specified material listed above will be supplied soft temper.

Prices of Cotton and Silk Covered Wires furnished on request.

Comet is also furnished in ribbon and strip.

Specifications Size Limits for Hot Rolled Products

N hot rolled rods size limit is plus or minus .010" up to $\frac{3}{4}$ " square or round. On sizes between $\frac{3}{4}$ " and $\frac{1}{4}$ " dimensions are held within plus or minus $\frac{1}{4}$ ".

The limit of tolerance of hot rolled flats is plus or minus .010" on thickness and plus or minus $\frac{1}{32}$ " on width.

In cases where the metal is to be used for mechanical purposes, and size is of paramount importance, it should be so stated on the order so that the alloy may be rolled to size rather than to resistance.

Resistance Limits

The resistance limit on hot rolled flats or rods is plus or minus 8%. In those cases where the customer specifies the resistance, the metal is not held exactly to size but is rolled to the correct cross sectional area and within plus or minus 8% of the specified resistance.

Weight—Length Limits

Flats and rods in sizes smaller than $1\frac{1}{4}$ " square can be supplied in continuous lengths having a maximum weight of 55 pounds. These lengths can easily be calculated in the Table on "Rounds and Squares."

While these figures represent the maximum weight—length—relation, it should be understood that it is not possible to guarantee that all material will have that maximum relationship.

Size Limits for Cold Rolled Sheet

Sizes and dimensions listed in this catalog are standards, but special widths or thicknesses can be supplied. Full information will be given upon request.

See page 55 for description of sheet containers.

Nichrome Sheet Hot and Cold Rolled

Approximate Weight Per Cubic Inch 0.3 Lbs.

RECENT developments in the heat treating field have brought forward the need of "Nichrome" in sheet form. To meet this demand, the Driver-Harris Company is prepared to supply Hot or Cold Rolled "Nichrome" Sheet, "Nichrome" Containers and other special forms.

"Nichrome" is a high temperature resisting alloy, which resists oxidation at all temperatures up to 2000° F. Besides its great resistance to oxidation at high temperatures, "Nichrome" is resistant to the action of most acids and alkalies.

Full information will be given upon request.

Photo of Carburizing Containers made of "Nichrome" Sheet Manufactured under Henderson Patent No. 1,270,519



Additional D-H Alloys

In addition to the various alloys described in this catalog the Driver-Harris Company is equipped and prepared to melt, hot roll, cold roll and finish alloys containing nickel, chromium, iron, copper and various other elements. When the demands of the trade dictate a particular alloy of certain physical properties this company is prepared to supply such alloy and welcomes inquiries.

"Magno" is the registered trade mark applying to a manganese nickel alloy which is used in the manufacture of incandescent lamps and radio

tubes.

141 Alloy is an alloy of nickel and iron (70% Nickel) characterized chiefly by its high temperature coefficient of electrical resistance. The temperature coefficient of 141 Alloy is .004 per degree Centigrade between 20° and 100° C. and the specific resistance is 120 ohms per cir. milfoot annealed and 140 ohms per cir. milfoot hard.

Among the special alloys not mentioned previously in this data book, is the trade marked material "Climax" which is approximately a 25% to 28% Nickel alloy with an electrical resistance of 500 ohms per cir. milfoot. Its prominent application is in the glass industry for capping wire but it is also used somewhat extensively for rheostats in heavy sizes.

Driver-Harris also prepares a 36% Nickel Steel (Invar) characterized by an extremely low temperature coefficient of linear expansion up to 200°C. The temperature coefficient of linear expansion of this alloy is approximately .000002 per degree C. between 20°C. and 125°C. and .0000097 per degree C. from 20° to 400°C. Above this temperature the alloy has about the expansion of Bessemer Steel. One of the applications of this alloy is in bimetallic thermostat elements.

Other Nickel Steels are available. The most common being 42% and 48% Nickel, notable for their coefficient of linear expansion approxi-

mating that of various grades of glass.

Driver-Harris hot rolling facilities are such that hot rolled specifications can be handled at all times.

"Nichrome" is used as the element in this large carburizing furnace



Useful Data

Direct Electric Current

Ohms Law E=IR

Where E=Electromotive force in volts, I=Current in amperes, R=Resistance in ohms.

In any direct current circuit the total resistance R of several resistances $(r_1, r_2, r_3, \text{ etc.})$ connected in series equals the sum of resistances.

$$R=r_1+r_2+r_3+\ldots r_n$$

In any direct current circuit the total resistance R of several resistances $(r_1, r_2, r_3, \text{ etc.})$ connected in parallel is computed as follows:

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2} + \frac{1}{r_3} + \dots + \frac{1}{r_n}$$

The heat developed in a conductor is directly proportional to the resistance, the square of the current and the time during which the current flows.

$H = I^2Rt \times 0.0009478$

Where I is the current in amperes, R is the resistance in ohms, t is the time in seconds, H is the heat in BTU.

To find the approximate resistance of R_t , of a wire at any temperature. $R = R_0 (1+xt)$

Where R_t is the resistance at temperature t, R_{\circ} , is the resistance given in the table, x is the temperature coefficient, and t is the difference in temperature between R_{\circ} and R_t .

The power W in watts consumed in any direct current circuit is equal to the product of the volts and the amperes.

$$W = EI = I^2R$$

Under similar conditions, the carrying capacity of two wires of equal diameter but of different materials, varies inversely as the square root of their specific resistances at the same temperature.

Properties of Materials

Material	at 20° Ce	specific Kesistance at 20° Centigrade	Temperature Coefficient	Coefficient of Linear	Approx.	Maximum Working	Tensile Strength	9	Weight
	Microhm Cms.	Ohms Per Circular Mil-Foot	Per Deg. C. Between 20°C. to 100°C.	Expansion Per Deg. C. 20°C. to 100°C.	Point Deg. C.	Tempera- ture Deg. C.	Pounds Per Square Inch (Annealed)	Gravity	Cubic Inch Pounds
Silver	1.60	9.75	0.0040	×	096	:	42,000	10.6	.381
Copper (USS)	1.751	10.55	0.0040		1085	:	35,000	8.9 6.8	0320
Special Bronze (Low Brass)	5.86	32.3	00000	1.75 x 10-6			41,000	180.0	310
Zinc	0.302	30.0	0.0040	35 X	419		30,000	7.7	2100
Silicon Bronze	6.04	40.0		1.75 × 10-8	:	:	45,000	× ×	300
Tin	9.53	57.5	0.0048		232		4,000	7.3	.263
Iron (Pure)	10.145	61.1	0.0062	1.14 x 10-6 1.26 x 10-6	1575	200	52,000 61,000	7.7	.280
Galvanized Steel	11.05	66.7					75,000	7.8	. 280
Phosphor Bronze	11.6	70.0				:	20,000	88.88	.320
Platinum	11.932	72.0	0.0037	0.86 x 10-6	1710	- (20,000	21.2	.765
2% Manganese Nickel	13.95	95.0	0.00036	1.37 x 10-6	1435	200 400 900	000'6/	× ×	.320
	10.0	114 7	0 0041	9 09 5 10 6	968		3 000	11 4	410
Crucible Steel	19.10	115.0	0.0041	1.14 x 10-5	250		75,000	7.7	280
141 Alloy	19.9	120.0	0.0040			200		8.7	.314
Special Manganese Nickel	20.	120.0	0.0029	1.37 x 10-6	1435	200	74,000	0.00 0.00	320
10% INICKEL SHVET	30.0	100.0	0.00020		1069	7007	30,000	0.01	669
30% Nickel Silver	40.2	241 0	0.000199	1 73 x 10-6	7001	260	000.09	0.00	.314
Manganin	48.3	290.0	+0.00002			100	70,000	8.15	.294
Lucero	42.6	256.	(20°C35°C.) 0.0019	1.35 x 10-5	1360	200	75,000	8.9	.320
Advance (Ideal)	48.8	294.0	±0.00002	1.44 x 10-5		500	62,000	8.9	.320
Climax (Phoenix)	83.0	500.0	0.000978			009	75,000	8.15	294
Nichrome III (Rayo)	89.5	540.0	0.00015		1390	1100	110,000	× 00 00	306
Comet (193 Alloy)	92.0 104.0	550.0	0.000100	1.71 x 10-8 1.32 x 10-5	1390	1150	120,000	8.5	908
Nichrome (Calido)	9.111	675.0	0,00017	1.37 x 10-6	1350	1000	100,000	8.15	.294

Data given above is representative of these alloys and represents average values.

Weight of Resistance Ribbon in Pounds Per 1000 Feet

This table is for Nichrome. To find the weight of Advance, S.M.L. Alloy, or Nickel, multiply by 1.09. To find the weight of Nichrome IV, multiply by 1.04.

PICK	Thickness												
No.	T. A. L.	1771	1,30,1	3,611	. %	3 16"	14"	, xx , xx	1,2,"	2 8	34"	1,,	B. & S.
ŝ	Inches	725	01							140 0	168.0	224.0	14
	064					42.0	2000	104.0	100	125.0	150.0	200.0	15
40 3	057									112.0			16
-	500					- 20				100			17
-	100.									0.00			18
17	.043			13.2	17.6					0-00			
_	040												19
1	-												20
_	.036									0.07	700	100	200
-	.032	-100											170
	0285												777
22	0254		5.6	7 CO	10.0	100	0.02	30.0	40.0	50.0	_'		23
~	0226								1	-			10
										44.0	53.0	0.07	770
_	0201												220
	0179												97
	0159												7
7	0142	1 56	3.1	4.70	6.25	200	17.0	16.6	22.0	27.6	33.0		287
200	0126	1.38										1	00
					1		10.9			25,6	30-7	41.0	570
0	0113						701	19.7	17 0				30
	0100						30						31
-	0000				-		0.0						32
- 0	0000						0 /					-	33
32	0000	20.00	1.56	2 34	3.12		62.5				- 1		-
2	1700.								11 9			22.4	34
1.	0000						_		10				35
4	.0003				-		٠.		0.0				36
2	9900								000				3
9	.0020								0.8	10.0	12.0	0071	38
7	.0045	0.50	3.0	00.1	20.7	9.64	3 52	5.3	7.0				5
38	0040												26
				1 14	1		3.04	4.6	6.1	9 2	9.15	10.2	40
39	.0035	0 32	99	00 0	1 32	1 98	2 64						

Weight Per Running Foot of Rounds, Squares, Hexagons and Octagons

This table is for Nichrome and Comet. To find the weights of Advance,
Lucero and Nickel multiply by 1.09. To find weights of
Nichrome IV multiply by 1.04

Size Inches	Rounds	Squares	Hexagons	Octagons	Size	
1 16 1 8 3 16 1 4 5 16	.0109 .0437 .0975 .173 .270	.0139 .0556 .1241 .221 .345	.012 .048 .108 .191 .298	.0115 .046 .1028 .1823 .286	1 16 1 5 3 16 1 4 5 16	
3 /8 7 /16 1 /2 9 /16 5 /8	.390 .530 .693 .876 1.082	. 496 . 676 . 884 1.115 1.380	. 430 . 585 . 763 . 966 1 . 193	.411 .559 .730 .922 1.142	3 8 7 16 1 ½ 9 16 5 8	
11/16 3/4 13/16 7/8 15/16	1.310 1.558 1.830 2.122 2.517	1.668 1.985 2.330 2.704 3.200	1.443 1.716 2.016 2.34 2.675	1.381 1.642 1.932 2.234 2.646	11 16 3 4 13 16 7 8 15 16	
$ \begin{array}{c} 1 \\ 1^{1}_{16} \\ 1^{1}_{8} \\ 1^{3}_{16} \\ 1^{1}_{4} \end{array} $	2.772 3.128 3.504 3.908 4.329	3.536 3.982 4.460 4.975 5.520	3.06 3.44 3.86 4.31 4.76	2.918 3.32 3.69 4.12 4.56	$\begin{array}{c} 1 \\ 1_{16} \\ 1_{18} \\ 1_{316} \\ 1_{14} \end{array}$	
$ \begin{array}{c} 15_{16} \\ 13_{8} \\ 17_{16} \\ 11_{2} \\ 11_{16} \end{array} $	4.774 5.240 5.726 6.232 6.767	6.078 6.592 7.291 7.940 8.614	5.27 5.76 6.30 6.87 7.45	5.03 5.52 6.03 6.57 7.13	$\begin{array}{c} 1^{5}_{16} \\ 1^{3}_{8} \\ 1^{7}_{16} \\ 1^{1}_{2} \\ 1^{9}_{16} \end{array}$	
$ \begin{array}{c} 1^{5}_{8} \\ 1^{11}_{16} \\ 1^{3}_{4} \\ 1^{13}_{16} \\ 1^{7}_{8} \end{array} $	7.324 7.889 8.488 9.103 10.068	9.320 10.048 10.816 11.590 12.800	8.07 8.72 9.35 10.05 10.73	7.71 8.30 8.94 9.58 10.58	$\begin{array}{c} 1^{5} \\ 1^{11} \\ 1^{3} \\ 1^{13} \\ 1^{13} \\ 1^{7} \\ 8 \end{array}$	
1 ¹⁵ / ₁₆	10.400 11.088	13.245 14.144	11.48 12.24	10.96 11.67	$\frac{1^{15}}{2}$ 16	

Weight Per Running Foot of Flats

Table for Nichrome (Calido), Comet (193 Alloy) and Manganin. Multiply by 1.09 to find weight of Advance (Ideal), Lucero and Nickel. Multiply by 1.04 to find weight of Nichrome III (Rayo) and Nichrome IV (Karma). Multiply by 0.946 to find weight of Cold Rolled Strip Steel.

nch	Decimal	1/16"	1.8"	1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1''	Inch
1,32	.03125	.007	.014	.028	.041	.055	.069	.083	.097	.110	1/82
3/16	.0625	.014	.028	.055	.083	.110	.138	.166	.193	. 221	1/16
3/82	.09375	.021	.041	.083	.124	.166	.207	.248	.290	.330	3/82
1/8	125	.028	.055	.112	.166	.221	. 276	.331	.386	.441	1/8
5/82	15625	.035	.069	.138	.207	.276	.345	.414	. 482	.551	5/82
3/16	. 1875	.041	.083	.166	.248	.331	.414	. 497	.579	. 662	3/16
7/82	.21875	.048	.097	. 193	.290	.386	. 482	. 578	. 675	.771	7/82
1/4	.25	.055	.110	.221	.331	.442	. 552	. 663	.773	. 883	1/4
9/32	.28125	.062	.124	.248	.372	. 496	.621	.744	.868	.992	9/32
5 16	.3125	.069	.138	.276	.414	. 552	. 690	. 828	.966	1.103	5/16
11/32	.34375	.076	.152	.304	. 456	. 607	.758	.912	1.062	1.214	11/82
3/8	.375	.083		.331	.497	. 663	.828	.993	1.158	1.325	8/8
13/52	.40625	.090	1	.358	. 538	.716	.896	1.076	1.253	1.434	13/32
7/16	. 4375	.097	. 193	.386	.579	.773	.966	1.158	1.352	1.546	7/16
15/82	. 46875	.104		.413	. 621	.828	1.035	1.242	1.448	1.656	15/82
1/2	.50	.110	.221	. 441	.662	. 883	1.103	1.325	1.546	1.766	1/2
17/32	. 53125	.117	.234	.468	. 703	.938	1.173	1.406	1.641	1.874	17/82
9/16	. 5625	.124	.248	. 496	.744	. 992	1.242	1.490	1.737	1.986	9,10
19/32	59375	.131	.262	. 524	.787	1.048	1.312	1.573	1.833	2.09	19/8
5/8	. 625	.138	.276	. 552	.828	1.103	1.380	1.656	1.93	2.21	5/8
21/32	. 65625	.145	. 290	.578	.870	1.158	1.448	1.738	2.03	2.32	21/3
11/16	.6875	.152	.304	.607	.912	1.214	1.517	1.820	2.13	2.43	11/1
23/32	.71875	.158	.317	. 634	.953	1.269	1.586	1.904	2.22	2.54	23/3
3/4	.75	. 166	.331	. 663	.993	1.325	1.656	1.987	2.32	2.65	3/4
25/82	.78125	.172	.345	.688	1.035	1.378	1.725	2.07	2.41	2.76	25/3
13/16	.8125	.179	.358	.716	1.076	1.434	1.792	2.15	2.51	2.87	13
27/82	.84375	.186		.745	1.117	1.490	1.863	2.22	2.61	2.98	27
7/8	.875	.193			1.158	1.546	1.932	2.32	2.70	3.09	1 3
29/82		.200			1.202	1.600	2.000	2.40	2.80	3.20	29
15/16		.20	1	.828	1.242	1.656	2.068	2.48	2.89	3.31	15
31/32	.96875	.21	4 .428	.855	1.283	1.711	2.140	2.57	2.99	3.42	31
1	1.00	.22	14		1.325	1.766	2.208	2.65	3.09	3.353	

- 1 inch (in.) = 1000 mils = 25.4001 millimeters (mm.)
- 1 foot (ft.) = 0.304801 meters (m.)
- 1 U. S. mile (mi.) = 1.60935 kilometers (km.)

AREA

- 1 square inch (sq. in.) = 6.452 square centimeters (sq. cm.)
- 1 square mil = 0.000001 sq. in. = 1.273 circular mils = 0.000645 sq. mm.
- 1 circular mil = 0.7854 sq. mils = 0.0005067 sq. mm.
- 1 circular mil is the area of a circle 1 mil in diameter
- The area of a circle in circular mils equals the square of the diameter in mils
- The area of a circle = 0.7854 x (diameter)²

MISCELLANEOUS CON-VERSION FACTORS

- 1 pound per foot = 1488.6 grams per meter
- 1 foot per pound = 0.0006566 meters per gram
- 1 ohm per foot = 3.2809 ohms per meter
- 1 foot per ohm = 0.30474 meters per ohm
- 1 ohm per pound = 0.003205 ohms per gram
- 1 pound per ohm = 453.46 grams per ohm
- 1 ohm per mil-foot=6.014 microhm-centimeters=601.4 ohms per square millimetermeter
- 1 ohm per square millimeter-meter = 0.01 microhm centimeters = 0.00166 ohms per mil-foot
- 1 microhm=centimeter=100 ohms per square millimeter-meter= 0.166 ohms per mil-foot
- 1 pound per square inch = .0007029 kilograms mm.
- 1 kilogram per sq. mm. = 1422.52 pounds sq. inch
- 1 pound avoirdupois=4536 kilogram
- 1 kilogram = 2.2046 pounds

1 kw. hour = 2,655,000 ft. lbs. 3,600,000 joules 3411 B. T. U. 367,100 kilogram meters

DECIMALS OF AN INCH FOR EACH SIXTY-FOURTH

164-.015625 -.031253/4-.046875 -.0625564-.078125 -.09375 3/32 7/64-. 109375 .125 1/8 964-.140625 5/32 -.15625 11/64-.171875 3/16 . 1875 13/64-.203125 7/32 .21875 15/64-234375 250 1/4 17/4-.265625 .28125 19/64-. 296875 5/16 .3125 21/64-.328125 11/32 34375 23/64-.359375 375 3/8 25 64-390625 13/32 40625 27/64-. 421875 7/16 .4375 29 64 - 453125 15/32 46875 3164-484375 500 1/2 33 64 515625 17/32 53125 35 64 546875 5625 37/64-578125 59375 39 64 608375 625 5/8 41 61 640625 21/32 65625 43 64- 671875 11/16 -.6875 45 64-703125 23/32 71875 47 64-734375 .750 3/4 765625 25/32 78125 51 64-796875 13/16 8125 63 64-. 828125 27/32 84375 -.859375 .875 7/8 890625 90625 5964 -.921875 -.9375 6164-.953125 31/32 -.96875 63/61 -.9843751.000

Conversion Tables of Fahrenheit and Centigrade Scales

To change a temperature C, in degrees Centigrade, to F degrees Fahrenheit, multiply by $\frac{9}{5}$ and add 32

$$^{\circ}F = \frac{9}{5}C + 32.$$

To change a temperature F, in degrees Fahrenheit, to C degrees Centigrade, subtract 32 and multiply by $\frac{5}{9}$ ${}^{\circ}C = \frac{5}{9} (F - 32).$

9											
Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
0	32	230	446	460	860	690	1274	920	1688	1150	2102
5	41	235	455	465	869	695	1283	925	1697	1155	2111
10	50	240	464	470	878	700	1292	930	1706	1160	2120
15	59	245	473	475	887	705	1301	935	1715	1165	2129
20	68	250	482	480	896	710	1310	940	1724	1170	2138
25	77	255	491	485	905	715	1319	945	1733	1175	2147
30	86	260	500	490	914	720	1328	950	1742	1180	2156
35	95	265	509	495	923	725	1337	955	1751	1185	2165
40	104	270	518	500	932	730	1346	960	1760	1190	2174
45	113	275	527	505	941	735	1355	965	1769	1195	2183
50	122	280	536	510	950	740	1364	970	1778	1200	2192
55	131	285	545	515	959	745	1373	975	1787	1205	2201
60	140	290	554	520	968	750	1382	980	1796	1210	2210
65	149	295	563	525	977	755	1391	985	1805	1215	2219
70	158	300	572	530	986	760	1400	990	1814	1220	2228
75	167	305	581	535	995	765	1409	995	1823	1225	2237
80	176	310	590	540	1004	770	1418	1000	1832	1230	2246
85	185	315	599	545	1013	775	1427	1005	1841	1235	2255
90	194	320	608	550	1022	780	1436	1010	1850	1240	2264
95	203	325	617	555	1031	785	1445	1015	1859	1245	2273
100	212	330	626	560	1040	790	1454	1020	1868	1250	228:
105	221	335	635	565	1049	795	1463	1025	1877	1255	229
110	230	340	644	570	1058	800	1472	1030	1886	1260	230:
115	239	345	653	575	1067	805	1481	1035	1895	1265	230:
120	248	350	662	580	1076	810	1490	1040	1904	1270	231:
125	257	370	671	585	1085	815	1499	1045	1913	1275	232
130	266		680	590	1094	820	1508	1050	1922	1280	233
135	275		689	595	1103	825	1517	1055	1931	1285	234
140	284		698	600	1112	830	1526	1060	1940	1290	235
145	293		707	605	1121	835	1535	1065	1949	1295	236
150 155 160 165 170	302 311 320 329 338	385 390 395	716 725 734 743 752	610 615 620 625 630	1130 1139 1148 1157 1166	840 845 850 855 860	1544 1553 1562 1571 1580	1070 1075 1080 1085 1090	1958 1967 1976 1985 1994	1300 1305 1310 1315 1320	237 238 239 239 240
175 180 185 190 195	347 356 365 374 383	410 415 420	761 770 779 788 797	635 640 645 650 655	1175 1184 1193 1202 1211	865 870 875 880 885	1589 1593 1607 1616 1625	1095 1100 1105 1110 1115	2003 2012 2021 2030 2039	1325 1330 1335 1340 1345	241 242 243 244 245
200 205 210 215 220 225	392 401 410 419 428 437	435 440 445 450	815 824 833 842	665 670 675 680	1238 1247 1256	905	1661 1670	1130 1135 1140	2084	1355 1360 1365 1370	246 247 248 248 248 249 250

Comparison of Wire Gauges

Gauge No.		rown & Sha or America		Old English or London	Birm- ingham or Stubs	W. & M. and Roebling	British Stand- ard or Imperial	U. S. Stand- ard	Gauge No.
	Diam. in Inches	Area Square Inches	Area Circular Mils	Diameter of Wire in Inches					
0000 000 00 00 0	.46000 .40964 .36480 .32495 .28930	.166 .132 .105 .0829 .0657	212,000,0 168,000.0 133,000.0 106,000,0 83,700.0	. 454 . 425 . 380 . 340 . 300	.454 .425 .380 .340 .300	.393 .362 .331 .307 283	.400 .372 .348 .324 .300	.406 .375 .344 .313 .281	0000 000 00 0 0
2 3 4 5 6	.25763 .22942 .20431 .18194 .16202	.0521 .0413 .0328 .0260 .0206	66,400.0 52,600.0 41,700.0 33,100.0 26,300.0	.284 .259 .238 .220 .203	284 259 238 220 203	.263 .244 .225 .207 .192	276 252 232 212 192	266 250 234 219 203	2 3 4 5 6
7 8 9 10	.14428 12849 11443 10189 .09074	.0164 .0130 .0103 .00815 .00647	20,800.0 16,500.0 13,100.0 10,400.0 8,230.0	.180 .165 .148 .134 .120	.180 .165 .148 .134 .120	177 162 148 135 120	.176 .160 .144 .128 .116	188 172 156 141 125	7 8 9 10 11
12 13 14 15 16	.08081 .07199 .06408 .05706 .05082	.00513 .00407 .00323 .00256 .00203	6,530.0 5,180.0 4,110.0 3,260.0 2,580.0	.109 .095 .083 .072 .065	.109 .095 .083 .072 .065	.105 .092 .080 .072 .063	-104 .092 .080 .072 .064	109 0938 0781 0703 .0625	12 13 14 15 16
17 18 19 20 21	.04525 .04030 .03589 .03196 .02846	.00161 .00128 .00101 .000802 .000636	2,050.0 1,620.0 1,290.0 1,020.0 810.0	.058 .049 .040 .035 .0315	.058 .049 .042 .035 .032	.054 .047 .041 .035 .032	056 -048 -040 -036 -032	.0563 0500 .0438 .0375 .0344	17 18 19 20 21
22 23 24 25 26	.02535 .02257 .02010 .01790 .01594	.000505 .000400 .000317 .000252 .000200	642.0 509.0 404.0 320.0 254.0	.0295 .027 .025 .023 .0205	.028 .025 .022 .020 .018	028 025 023 020 018	.028 .024 .022 .020 .018	0313 0281 -0250 0219 -0188	22 23 24 25 26
27 28 29 30 31	01420 .01264 .01126 .01003 .00893	000158 000126 0000995 0000789 0000626	101.0	01873 0165 0155 01373 01225	.014 .013 .012	.017 .016 .015 .014 .0135	.0164 .0148 .0136 .0124 .0116	.0172 .0156 .0141 .0125 .0109	27 28 29 30 31
32 33 34 35 36	.00795 .00708 .00630 .00561 .00500	.0000496 0000394 .0000312 .0000248 .0000196	50 1 39 8 31 5	.0112 .0102 .0095 .009 .0075		.013 .011 .010 .0095 .009	0108 .010 .0092 .0084 .0076	.0094 .0086 .0078	33 3- 35
37 38 39 40	.00445 .00397 .00353 .00314	.0000156 .0000123 .0000098 .0000078	15.7 12.5		5	. 0085 . 008 . 0075 . 007	.006	,0063	38 39 40

Nichrome Castings

WHEN carburizing, vitreous enameling, glass making, heat treating and other processes involving high temperatures became larger industrial factors, the Driver-Harris Company applied their energies and resources to the problem of manufacturing and supplying special castings which would endure in high temperatures.

After a great deal of research and experiment such a type of casting was developed and perfected, and marketed under the Driver-Harris Company Trade Mark, "Nichrome".

"Nichrome" Castings do not crack, warp, or scale under repeated heating and cooling in oxidizing atmospheres or under various operating conditions where other castings fail.

Information in connection with numerous applications and the suitability of "Nichrome" Castings may be had by sending blueprints and data to the Driver-Harris Company.

Cast "Nichrome" is used extensively for carburizing and case-hardening Carburizing containers are manufactured under Henderson Patent No. 1,270,519





Weights of Coils and Spools

IN gauges of No. 17 B. & S. and larger, the Driver-Harris Company supplies wire in coils; all sizes smaller than No. 17 B. & S. being furnished on spools.

The following table gives the approximate quantity placed on a spool or in a coil, but is subject to some variation. This variation is more apt to occur between sizes 18 to 24 B. & S.

. How Sup- plied	Approximate Weight per Unit				
Coiled	15 to 50 lbs. per coil				
Spooled	8 to 12 lbs. per spool				
6.6	3 to 5.5 lbs. per spool				
4.4	0.75 to 2.5 lbs. per spool				
6.6	0.25 to 1 lb. per spool				
6.6	0.10 to 0.20 lb. per spool				
	Supplied Coiled Spooled "" ""				



Summary of D-H Products

Wire-Ribbon-Strip-Rods

For Electrical Purposes

Nichrome* IV Comet* Manganin Nichrome* Lucero* Nickel Advance*

For Mechanical and Chemical Purposes

Nichrome* Monel Metal Low Brass Nickel Bronze Phosphor Bronze Lucero* High Brass

For Spark Plugs

Magno*
Special Nickel Alloys

High Manganese Nickel
Monel Metal

For Thermo Couples Advance*

Flexible Stranded and Braided Wires From any of our alloys

Rods—Strips—Sheets

Nichrome*
Nichrome* IV
Special Nickel Alloys
Lucero*

Ferro Nickel Alloys
Ferro Chromium
Monel Metal
Magno*

Advance*
Invar
Manganin
Comet*

Cords

Braided Heater Cord—Veriflex, Wrapped Asbestos Curling Iron Cord Heater Pad Conductor

"Nichrome" Castings
For Heat Resisting Purposes

Carbonizing Containers
Lead, Cyanide and Salt Pots
Retorts

Tubes
Furnace Parts
Dipping Baskets

Pyrometer Tubes
Enameling Racks
Chains

"Nichrome"* B
For Addition to Cast Iron

"Chromax"*

For heat-resisting purposes at medium temperatures

"Nichrome"* Valves

For Marine Diesel Engines and Heavy Duty Gas Engines

Hot Rolled Carbon and Tool Steels

in Round-Square-Hexagon-Octagon and Special Shapes

*Trade Mark Reg. U. S. Pat. Off.

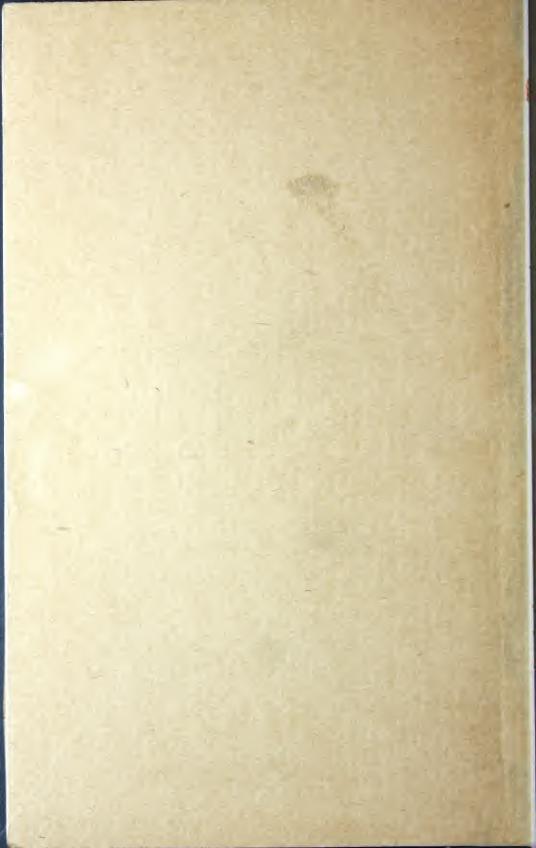




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